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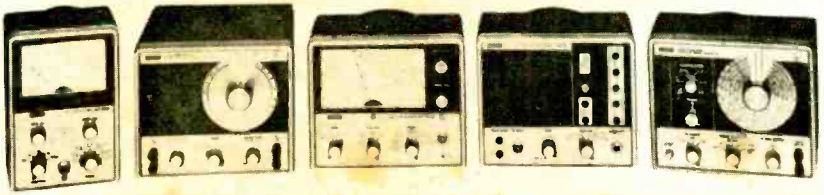

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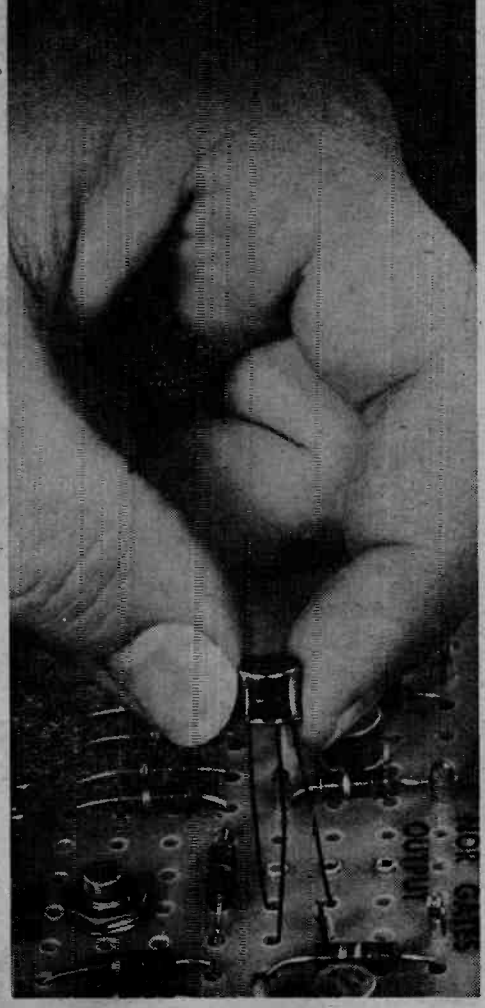

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NATTS

June/July 1970

Science and Electronics

PROJECTS WITH AN ANTIQUE FLAIR

★ 27 Roto-Stat Electrostatic Powerhouse—*gotcha! and with gadget Plato knew about, Franklin improved on, and that'll still be around in the year 2525*

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Emergency Radio Services—Detroit Area—page 97

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★ Cover Highlights

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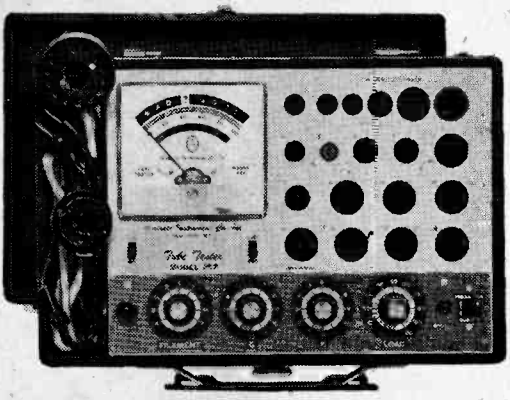

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Volume 28 **Number 3**

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SCIENCE AND ELECTRONICS is published bi-monthly by Science & Mechanics Publishing Co., a subsidiary of Davis Publications, Inc. Editorial, business, and subscription offices: 229 Park Avenue South, New York, N.Y. 10003. One-year subscription (six issues—$4.00; two-year subscription (12 issues)—$7.00; and three-year subscription (18 issues)—$10.00. Add $1.00 per year for postage outside the U.S.A. and Canada. Advertising offices: New York, 229 Park Avenue South, 212-OR 3-1300; Chicago, 520 N. Michigan Ave., 312-527-0330; Los Angeles: J. E. Publishers Rep. Co., 8560 Sunset Blvd. 213-659-3810; Long Island: Len Osten, 9 Garden Street, Great Neck, N.Y., 516-487-3305; Southwestern advertising representative: Jim Wright, 4 N. 8th St., St. Louis, 314-CH-1-1965.

EDITORIAL CONTRIBUTIONS must be accompanied by return postage and will be handled with reasonable care; however, publisher assumes no responsibility for return or safety of manuscripts, art work, or photographs. All contributions should be addressed to the Editor, SCIENCE AND ELECTRONICS, 229 Park Avenue South, New York, N.Y. 10003.

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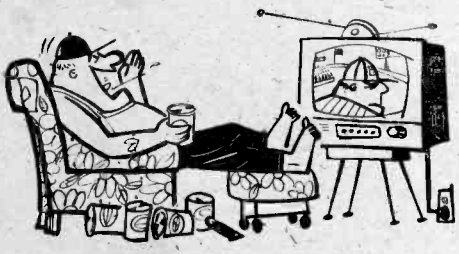

POSITIVE FEEDBACK

Julian M. Sienkiewicz
EDITOR-IN-CHIEF

The great mail strike of 1970 is now ancient history to most people (unless they'll have pulled another one on us ere now), but not to you, my dear readers. While you are thumbing through this issue of SCIENCE AND ELECTRONICS, you will find that one of our regular columns, "Famous Patents," is not present. Alas, it was in a mail bag somewhere in the vastness of the New York General Post Office as we were setting type for this here issue. But don't fret. Our Famous Patent columnist, Arthur Cookfair, has conspired with us to employ the services of that "Leave the driving to us" hound, so that we'll be able to catch up with patent history by the next issue.

Hot Stuff! The Seventies will see the introduction of electronics to milady's kitchen. It's been a long time coming, but it's here—and there is no stopping it. Radar (microwave) ovens, formerly relegated to short-order restaurants in the past, will be standard items in over 100,000 homes this year. What will happen to the sales of these home ovens in 1971 will probably make the air-conditioning marketplace look like five-and-dime store stuff.

To discover how they cook with "cool" heat, I suggest you read our article beginning on page 55 of this issue.

I would like to hear from our readers who own microwave ovens and are using them. What I would like to know is "exactly how good they really are, is improvement needed with the model presently in use, what cooks good and what does not?" We prefer not to believe makers' claims. *Too* many "blue sky" statements are made by *too* many appliance manufacturers lately. There is nothing as good as the final consumer test performed by the consumer in the home.

And say, fellahs, if you want to get your wife's name in print, why not send in your better half's favorite recipe for cooking or baking in a microwave oven. This is not a contest, but the best recipes will be judged by the salivation of this editor and published. Let's hear from you! ■

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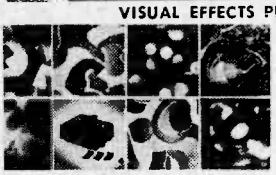

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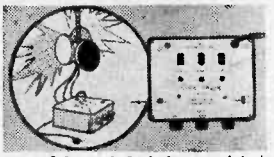

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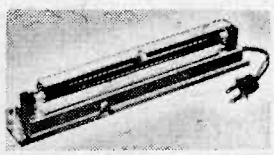

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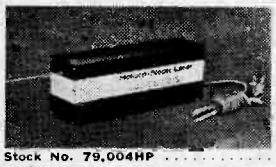

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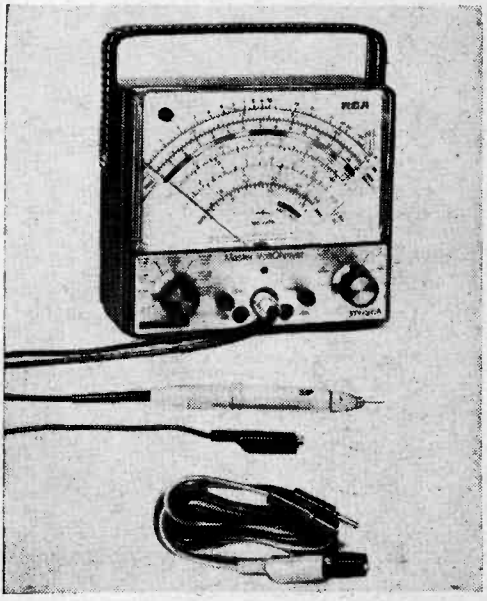
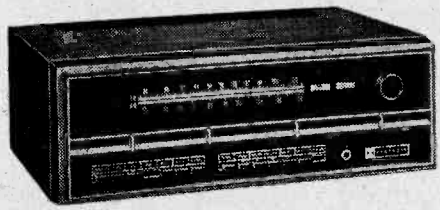


RCA WV-510A Master VoltOhmyst

Put Together 60 Watts of Stereo

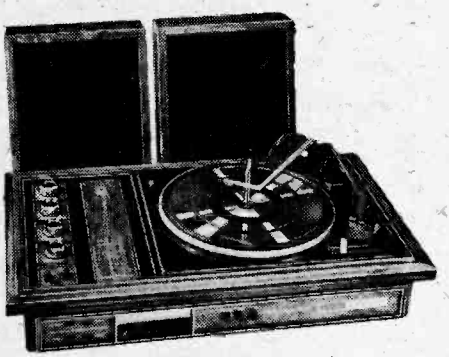
Last time out, we reported on the Heathkit AR-29 AM/FM/FM-stereo receiver, which puts out 100 watts. Now for those of you who don't need all those watts, here's the AR-19, a 60-watt job, and naturally it's more moderately priced. The AR-19 features the same advanced FET, IC design as the AR-29. There are five integrated circuits for a total of 57 transistors and 35 diodes. Frequency response is from 6 to 35,000 Hz with less than 0.25% harmonic distortion at any power level (Heath says this is the lowest distortion of any receiver in this power class). For the ease and comfort of the kit builder, all eight circuit boards snap in and out in seconds. This also means that later checking of circuits can be done with a minimum of dismantling. The factory-assembled FM tuner has a 2.0-μV sensitivity. Unit has necessary output terminals to connect a second pair of stereo speakers for use in another room, or you can connect three speaker systems —right, center (mixed), and left. With Heath's Black Magic panel lighting no dial or scale markings show til the set is turned on. Price of the AR-19 is $225.00. For more dope, write the Heath Co., Benton Harbor, Mich. 49022.



Heathkit AR-19 AM/FM/FM-Stereo Receiver

Ambidextrous System

Lafayette's new LSC-888 combines a solid-state stereo modular phono with an 8-track tape system—a happy combo! The LSC-888 brings together a Garrard 4-speed automatic record changer, an 8-track tape system, a 20-watt solid-state amplifier, and a pair of acoustically matched speaker systems. The record changer has tubular tonearm with stereo turnover car-



Lafayette LSC-888 Stereo Phono and Tape System

tridge and diamond needle, plus cueing control. The amplifier controls include balance, bass, treble, volume, selector; there's also an automatic shut-off switch, a front panel stereo headphone jack, and an auxiliary input jack for tuner or tape recorder. Speakers are 8 in. There's a tinted plastic dust cover and a 45 rpm spindle. Control unit measures 23½ x 4 x 14 in.; speakers, 15 x 10 x 4⅞ in. Price of the LSC-888 is $149.95, and for more specs write to Lafayette Radio Electronics, 111 Jericho Tpke., Syosset, N.Y. 11791.

Tuning Fork with Electronic Brain

With the new Schober Electronic Tuning Fork you can tune any musical instrument, except a piano, which requires a process known as "stretching." Fork provides 12 steady tones, middle C through the B above it. Pitch accuracy is within 5 cents (5% of a semitone). A special knob sets the scale a A=440 but permits resetting to anything between about 435 and 445. The tones have harmonics, making the zero-beat tuning technique easier and permitting the fork to be used directly to tune in-

Schober Electronic Tuning Fork

struments in higher and lower octaves. Housed in a strong wooden case, 5½ x 7 x 3 in., it operates on two 9-volt transistor radio batteries and has its own built-in speaker. A voltage regulator maintains pitch accuracy during the entire life of the batteries—about 18 hours

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continuous operation and several times that in normal use. The fork is factory-calibrated for pitch accuracy; price is $49.95. For detailed descriptive sheet write The Schober Organ Corp., 43 W. 61st St., New York, N.Y. 10023.

8-Track or 4? Be Adaptable!

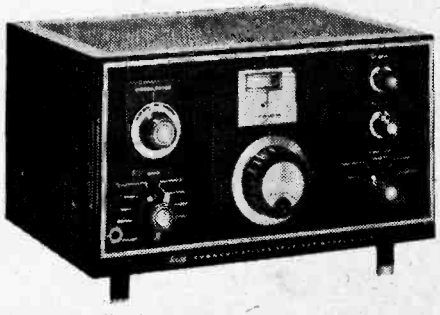
Panasonic adds another item to its line of car stereo accessories by introducing a cassette adaptor pack which allows you to play a 4-track stereo cassette in any Panasonic 8-track tape player. Designed specifically for the car, it fits into an 8-track tape player like an ordinary stereo catridge and plays cassette tapes

Panasonic CJ-980 Cassette Adaptor Pack

instantly. A panel light automatically switches *on* to signal the end of a tape. The cassette adaptor pack, Model CJ-980, comes with a leatherette carrying case and polishing cloth, and is priced at $39.95. For more details write Panasonic, 200 Park Ave., New York, N.Y. 10017.

Slam-Bang Ham Band Box

Allied has a new, moderately-priced 80- to 10-Meter ham band receiver that, they say, not only has highly satisfactory performance, but, also, clean, attractive styling that will please your XYL. Model A-2516 features a deluxe filter for highly selective AM, CW, and SSB reception on all ham bands between 3.5 and 29.7 MHz. This includes 80, 40, 20, 15, and 10 Meters, as well as the WWV signal on 10 MHz. Unit has a crystal-controlled first local



Allied A-2516 Ham Receiver

oscillator and a solid-state VFO-type second oscillator with negligible frequency drift. The VFO circuit has output terminals for use as a transmitter VFO. The mechanical IF filter provides a 1.5-kHz bandwidth at 6 dB down, 6 kHz at 60 dB down. Sensitivity is 1.5 μV for 10 dB signal-to-noise ratio at 14 MHz. Image ratio and IF rejection are better than 40 dB at 14 MHz. Price is $169.95 and for more specs you can write to Allied Radio Corp., 100 N. Western Ave., Chicago, Ill. 60680.

Carry-O the Stere-O

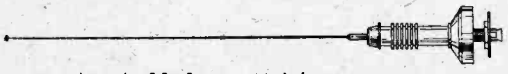
Heathkit has a new portable stereo phonograph, the GD-109. It has 18 watts output, a deluxe record changer, and full-range speakers. Each 4½-in. speaker can be lifted off the changer cabinet and placed up to 5 ft away. The 9-watt per channel solid-state amplifier is combined with a preassembled, 4-speed automatic record changer—a Maestro—which tilts

Heathkit GD-109 Portable Stereo Phonograph

up and locks for portability. The GD-109 features a ceramic stereo cartridge having 30 dB separation; diamond stylus pressure is a low 3½ grams. Controls include volume, tone, and balance, and there's a 45-rpm adapter. Cabinet is wood with plastic-coated covering and the price is $74.95. For additional information, write the Heath Co., Benton Harbor, Mich. 49022.

Vehicular Vane

Avanti has three new tunable antennas for vehicular applications, featuring base-loaded and ruggedized construction. Model numbers apply as follows: SS-27, 27 to 33 MHz; SS-34, 34 to 40 MHz; SS-45, 40 to 50 MHz. All three have taper ground stainless steel whips and can be tuned to exact frequency. Loading coil is finned to aid heat dissipation and potted in epoxy for water proofing. Nominal impedance is



Avanti SS Series Mobile Antenna

50 ohms; power handling, 100+ watts. The antennas come with their own integral mounts, 20 ft of RG-58/U cable, and PL259 connectors,

and are guaranteed for one year. Components are heavy chrome-plated brass and are compatible with the new Avanti no-hole trunk lip base. Price of any of the models is $21.25. For more information write to Avanti Research & Development, Inc., 33-35 W. Fullerton Ave., Addison, Ill. 60101.

Two Can Listen as Cheaply as One

This new device from Robins Industries, called Twinfone, lets two persons in on a phone call. It has no moving parts and requires no electricity. One end of Twinfone slips over the earpiece, while a length of tubing carries the sound to another earpiece. What you have is the convenience of an extension phone without the expense of a second telephone instrument. A

Robins Twinfone

business associate can join in a call, a secretary can listen to take notes, or, both parents can chat simultaneously with a child away from home. Twinfone also helps the hard-of-hearing by amplifying the sound when the extra earpiece is held to the other ear. Twinfone is priced at $4.98, and you can get more dope from Robins Industries Corp., 15-58 127th St., College Point, N.Y. 11356. ■

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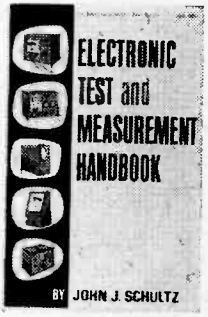
One for the Test Bench. Here's a "one-stop" source of practical electronic troubleshooting procedures, based on tried-and-tested measurement techniques. It's John J. Schultz's new text entitled *Electronic Test and Measurement Handbook*.

Covering a variety of tests on receivers, transmitters, transceivers, antennas (up to and including VHF), and a wide range of accessory



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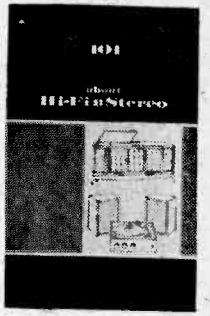
equipment, this is one handbook that clearly shows how to apply factual and crystal-clear information to testbench problems. Based on years of practical experience, the author tells how to measure even critical performance, using moderately-priced test equipment. Encompasses many tests that heretofore required the use of lab-type gear to equal the accuracy attainable with the methods outlined in this work. In each case there's a complete, detailed procedure and setup diagram to show how to conduct each test or measurement with ease. With the help of a thorough index the reader can find a specific test in seconds and be on his way to accurate, dependable measurements. Available directly from the publisher—Tab Books, Blue Ridge Summit, Pa. 17214.

The Answer Men. Since the early 1950's, the manufacture and sales of high fidelity equipment has become a multi-million dollar industry. And it seems that with each dollar, a question was asked. Authors Leo G. Sands and Fred Shunaman combined forces to answer 101 of the most asked questions. You guessed it, the title of this book is *101 Questions and Answers about Hi-Fi and Stereo.*

The question and answer format is the quickest way to inform an audio neophyte. The text is divided into six sections to aid the reader in finding the information he desires. The first section deals with hi-fi/stereo systems,



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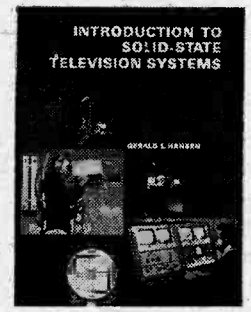
while the second and third sections discuss amplifiers and tuners respectively. Record and tape players are covered in the next two sections. Maintenance and troubleshooting procedures are given in the last section. Interested? Then write to the publisher—Howard W. Sams & Co., Inc., 4300 W. 62nd Street, Indianapolis, Ind. 46268.

Solid TV. Here's a text—*Introduction to Solid-State Television Systems* by Gerald L. Hansen—that's unique. It is devoted entirely to TV *today!* Its up-to-date information and broad, detailed coverage make it a "must" with anyone concerned with the vital, changing field of television today. No exceptional knowledge is necessary to understand the clear, readable text. The author has bypassed complex mathe-



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matical formulas, so that readers with a basic grasp of electronic and transistor theory will find the text readily comprehensible.

Several photographs and detailed diagrams of the latest transistorized circuits accompany the text, making it an excellent introduction to solid-state TV systems. That's how it got its title! For your copy, order directly from your local bookstore or direct from the publisher—Prentice-Hall, Inc. Englewood Cliffs, N. J. 07632.

You Can Do It! Here's just the book you've been looking for—*TV Troubleshooter's Handbook* by the Editors of Electronic Technician/Dealer. It's completely updated, quick-reference source for scores of tried-and-tested solutions to "tough-dog" TV troubles.

This detailed compilation of practical help

(Continued on page 102)

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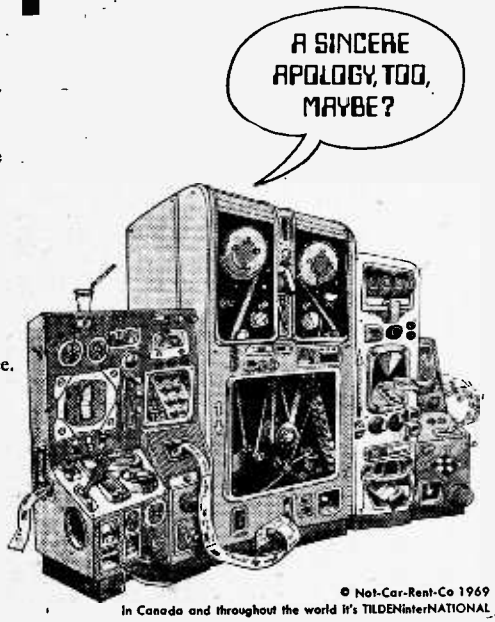

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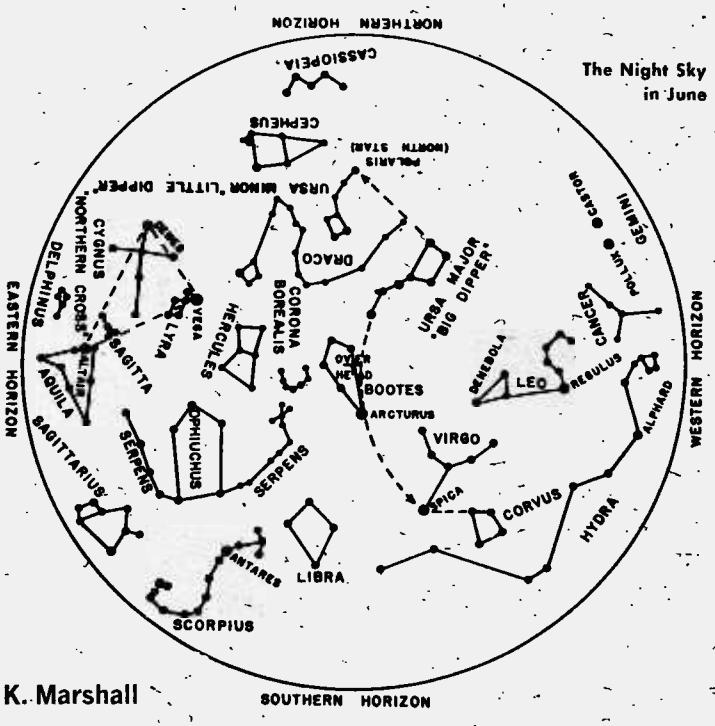
The Skies Above Us

by Dr. Roy K. Marshall



☆☆ When I look at the map of our June sky, I see almost exactly overhead the ruddy star Arcturus and I recall an evening in the Spring of 1933 when many thousands of people on the grounds of Chicago's Century of Progress Exposition awaited the moment when a signal from that star, caught by a photocell at the tailpiece of the greatest refracting telescope in the world, the 40-inch at the Yerkes Observatory, about 75 miles away, and carried by wire to Chicago, would trigger a relay atop the Hall of Science and turn on the lights of the most magnificent fairyland and most profitable (even in depression times!) exposition ever held (admission to the grounds, 50¢). In 1959-60, I went to Chicago for a little more than a year to reorganize the Adler Planetarium; my wages were paid from a fund resulting from the Century of Progress Exposition, a quarter-century earlier.

☆ They had picked Arcturus as the most conspicuous star with a distance most nearly 40 light-years, to tie it in with the other great world's fair, the Columbian Exposition in Chicago in 1893 (delayed a year from the quadricentennial of the voyage of Christopher Columbus, by labor strikes!). The distance of Arcturus is really 36.2 light-years, so the starlight we used in 1933 left that star in 1897, still a very appropriate year, because that's when the great telescope in its 90-foot dome at the Yerkes Observatory was installed.

☆ Note how the curve of the handle of the Big Dipper points out Arcturus and the white star Spica. We have quite a zoo in our summer sky, with two bears (Ursa Major and Ursa Minor, a water snake (Hydra), another snake in Serpens, a lion (Leo), a crab (Cancer), a scorpion, a dragon (Draco), a swan (Cygnus), an eagle (Aquila) and a dolphin (Delphinus).

☆ These can all be spotted in the June map, while we have three unnatural creatures in the July map. Sagittarius is normally called "The Teapot," from its shape, but classically it is a centaur, who is an Archer. And Capricornus is a "Sea Goat"—front half a goat, hind half a fish! Then, just peeping up on the eastern horizon (better seen later at night or later in the year), there's Pegasus, the beautiful winged horse that impudent Bellerophon tried to ride to the abode of the gods on Mount Olympus. Pegasus was bitten by a gadfly and bucked so hard that Bellerophon was thrown, and fell from the skies to be so badly maimed that he dragged out the remainder of his life as a lonely, unhappy cripple. Some poet has said of him, "Yet was it noble so to aspire." But you can't win 'em all!

☆ In the July map, we find two good men on the southern half of the meridian, the imaginary line that divides the sky into eastern and western halves. Hercules, almost overhead, is the famous hero and, when his figure is filled out with fainter stars toward the north, we find that he has one foot on the quadrilateral that marks the head of Draco, the dragon. The head of Hercules, not indicated, is a star just over the "C" of Ophiuchus, as the head of that latter giant is just below. This man is thought to

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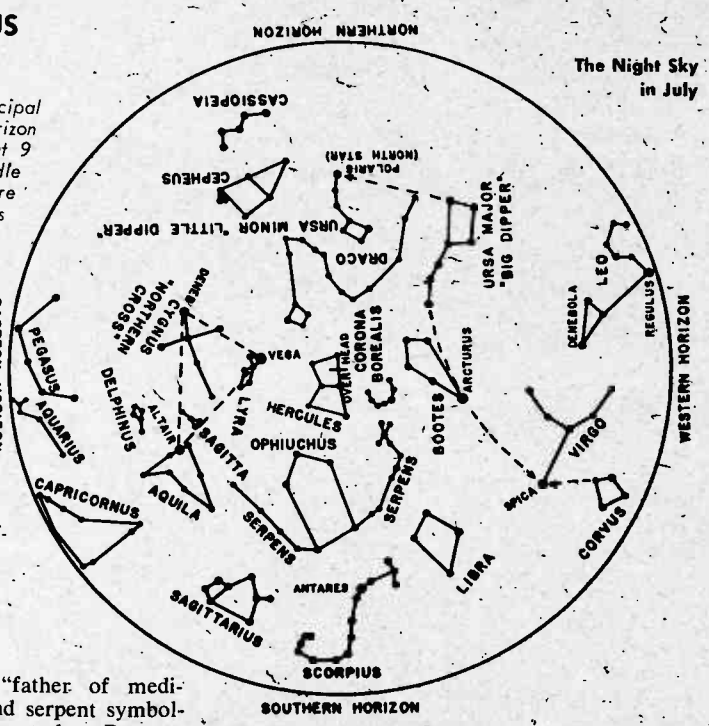
THE SKIES ABOVE US

☆☆☆ *The maps show the principal stars which are above the horizon at latitude 34° North at about 9 p.m. standard time at the middle of the month. These maps are practical star location guides anywhere in the United States throughout the month showing the sky at 10 p.m. on the first and at 8 p.m. on the last of the month. To look at the night sky in June and July, select the proper map and hold it vertically. Then turn the map so that the point of the compass toward which you are facing shows at the bottom of the map.* ☆☆☆ *Our special thanks go to the Griffith Observatory in Los Angeles, California.* ☆☆☆



represent Aesculapius, the "father of medicine," whose walking staff and serpent symbolize medical men and societies today. Because snakes shed their skins, ancient people thought that they renewed their lives.

☆ If your sky is not too flooded with the glow from lights, and you have binoculars or a small telescope, look carefully at the "overhead" marker in Hercules. There you may spot a fuzzy glow that is a magnificent globular star cluster, when photographed. And the Milky Way now arches halfway up in the eastern sky, through Sagittarius, Cygnus and Cassiopeia.

☆☆ If you can recall, in the last issue I was talking about how the calendar came about. Unfortunately, I ran out of space and will finish the discussion in this issue.

☆ It is the fourteenth day of Nisan, either the first or second full month after March 21, that is a very solemn holy day in the Hebrew calendar, commemorating the exodus of the children of Israel from their travail in Egypt. It is the Passover which, in 1970, is celebrated on April 21 because, while a full moon occurs on March 22, it falls in the embolismic month Veadar.

☆ Historians believe that it was probably Seti I who was the Pharoah who welcomed the Hebrews to Egypt during a time of famine. They made their homes in the land called Goshen, just to the east and northeast of modern Cairo. They were well treated and they prospered, as had Abraham and his family in Egypt, some 500 years earlier. But Seti died in 1290 B.C. and was succeeded by Rameses II who saw the Hebrews as possible future enemies. He made life miserable for them and reduced them almost to the conditions of slavery. Many times he promised to let them leave, but just as often he had broken his promise. Finally, Jehovah visited a dreadful calamity upon the Egyptians—the death of the firstborn child of every family, on the night of the full moon in the month of Nisan (then called Abib). But he had told the Jews to put lamb's blood on the side-posts and lintels of the doors of their homes as a sign, and these houses he "passed over." In the confusion, the Jews took their belongings and escaped from Goshen by crossing the salt marshes, then existing, called the Reed Sea (and not, as usually stated, "Red Sea," which was quite far away), where the pursuing chariots of Rameses bogged down.

☆ It is in remembrance of this event that the Jewish people celebrate the Passover, each year, as they have since the exodus, on the fourteenth day of the month Nisan, in the evening of the full moon. The proper date is set, as we have seen, by the lunar calendar.

☆ Jesus and his disciples were Jews and, as such, would not fail to observe the Passover. In the closing days of his life on earth, he sent Peter and John into Jerusalem to prepare the room where they would celebrate it. The Christians know this as the Last Supper and, because it was the Passover, we can date it and other events.

☆ We read that on the following day Jesus was arrested, tried and crucified. His body lay in a borrowed tomb over the Sabbath (Saturday) and the Resurrection occurred on the

(Continued on page 101)

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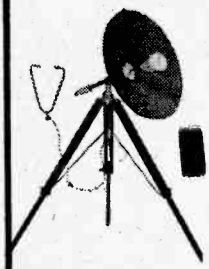
THE BIG EAR



"HOMES IN" on faint sounds up to 100 feet away... twice as far over water.

Exclusive cordless Broadcast Accessory also available—increase sensibility tenfold.

- USE INDOORS OR OUTDOORS – from baby sitting to bird watching.
- ENTERTAINING, PRACTICAL AND INSTRUCTIONAL for young and old.
- THE LATEST IMPALID STATE CIRCUITRY.
- PROTECTIVE DEVICES to listen for intruders at night.

The "BIG EAR" is an amazing electronic device which is completely portable. Basically it combines the principle of a parabolic microphone, a high gain amplification system and stethoscope earphone for intimate listening.

The "BIG EAR" comes complete with its own sturdy adjustable tripod base for convenient use anywhere... operates for hours on standard 9 volt transistor battery.

Complete with Stethoscope earphones ONLY $19.95 (less batteries)

BIG EAR BROADCAST ACCESSORY

Plug in our exclusive cordless Broadcast Accessory and convert Big-Ear into a group entertainment listening device. The "Big-Ear Broadcaster" let you broadcast sound to any FM receiver up to 30 feet away. With it you hear everything, without connecting wires with 30 times amplification.

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BROADCASTER COMPLETE ONLY $14.95
(less batteries)

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Complete SKY-SPY only! $16.95 (less batteries)

Amazing... excitingly new! "SKY-SPY" allows reception from planes within a range of 75 miles; even permits reception from the aircraft tower itself within a 15 mile range.

Hear how aircraft are instructed to land, weather conditions, delays in launchings, etc....

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ASTRO-COM WRIST RADIO Transmitter

- Broadcasts your voice to any FM receiver within 50 feet in any direction.
- No wires! Powerful tiny silver oxide battery good for hours of broadcasting!
- Great for party fun; kids' games; keeps you in touch with playroom, bedroom, or sick room.
- Complete with replaceable silver oxide battery, nylon strap, rugged case, "whip" antenna, and tuning device.
- Electronic components designed by Saxton first in miniature electronic equipment.

SPECIFICATIONS: Frequency Response: 300 to 6,000 hz.; POWER: 6 MW input; RANGE: Up to 50 feet, depending upon conditions; Frequency: FM broadcast band, (tunable ± 3 megacycles through 88 megacycles); Audio Sensitivity: Normal voice at approximately 10 feet; Case: High impact polystyrene-electronics encapsulated in epoxy; Weight: 4 ozs.

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Join "THE TROUBLESHOOTERS"

They get paid top salaries for keeping today's electronic world running

Suddenly the whole world is going electronic! And behind the microwave towers, push-button phones, computers, mobile radio, television equipment, guided missiles, etc., stand THE TROUBLESHOOTERS —the men needed to inspect, install, and service these modern miracles. They enjoy their work, and get well paid for it. Here's how you can join their privileged ranks—without having to quit your job or go to college in order to get the necessary training.

JUST THINK how much in demand you would be if you could prevent a TV station from going off the air by repairing a transmitter...keep a whole assembly line moving by fixing automated production controls...prevent a bank, an airline, or your government from making serious mistakes by servicing a computer.

Today, whole industries depend on Electronics. When breakdowns or emergencies occur, someone has got to move in, take over, and keep things running. That calls for one of a new breed of technicians—The Troubleshooters.

Because they prevent expensive mistakes or delays, they get top pay—and a title to match. At Xerox and Philco, they're called Technical Representatives. At IBM they're Customer Engineers. In radio or TV, they're the Broadcast Engineers.

What do you need to break into the ranks of The Troubleshooters? You might think you need a college degree, but you don't. What you need is know-how—the kind a good TV service technician has—only lots more.

Think With Your Head, Not Your Hands

As one of The Troubleshooters, you'll have to be ready to tackle a wide variety of electronic problems. You may not be able to dismantle what you're working on—you must be able to take it apart "in your head." You'll have to know enough Electronics to understand the engineering specs, read the wiring diagrams, and calculate how the circuits should test at any given point.

Learning all this can be much simpler than you think. In fact, you can master it without setting foot in a classroom...and without giving up your job!

For over 30 years, the Cleveland Institute of Electronics has specialized in teaching Electronics at home. We've developed special techniques that make learning easy, even if you've had trouble studying before. Our AUTO-PROGRAMMED® lessons build your knowledge as easily and solidly as you'd build a brick wall—one brick at a time. And our instruction is personal. Your teacher not only grades your work, he analyzes it to make sure you are thinking correctly. And he returns it the same day received, while everything is fresh in your mind.

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And no wonder. The licensing exam is so tough that two out of three non-CIE men who take it fail. But our training is so effective that 9 out of 10 CIE graduates pass. That's why we can offer this famous warranty with confidence: If you complete a license preparation course, you get your FCC License—or your money back.

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Want to know more? Send for our 44-page catalog describing our courses and the latest opportunities in Electronics. We'll send a special book on how to get a Government FCC License. Both are free—just mail the bound-in postpaid card. If card is missing, use coupon below.

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What's to Squelch?

I have a $59.95 8-band receiver that covers from 26 MHz to 174 MHz. What kind of antenna do I need for greater distance? I connected a piece of rubber-coated wire to an old car aerial, but aside from hearing the local police and taxis and two FM stations, I get nothing more. What can I possibly receive up here?

—R. D'V., Bangor, Maine

If the Bangor & Aroostock Railroad up there even installed the radio system they talked

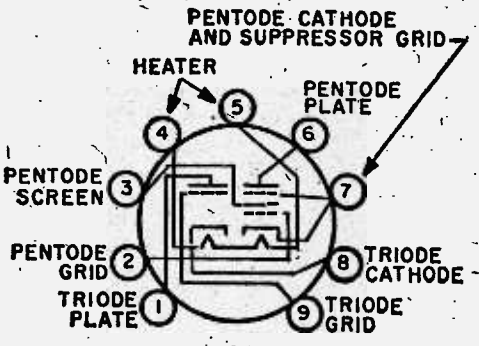
about in 1954, you might hear the crews trying to get the potato trains rolling on around 161 MHz. Otherwise there's not much DX to hear up there except CB and amateur stations. For better results, you need a CB antenna for 25-50 MHz reception, and a 148-174 MHz antenna. Be sure to mount them securely and as high as possible.

Tube Tester Up-Dated

The tube table for setting my tube tester for varius tubes doesn't list all of the tubes used in my TV set, such as a 6GH8A. How do I test them? The manufacturer of the tube tester is no longer in business.

—H. K., Newport, R. I.

Get a General Electric tube manual and look up the tubes you want to test. For example, you will find that the 6GH8A is a medium-mu triode/sharp-cut off pentode and its basing diagram is 9AE as illustrated here. Then look



9AE

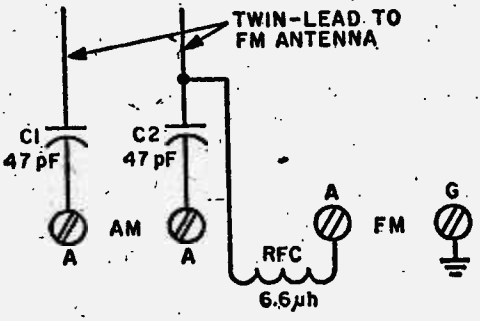
through the short form tube type listings in the manual and find another tube with the same basing diagram. You will find it to be a 6U8. It is the same basic tube with slightly different operating characteristics. Setting your tube tester for a 6U8 and plugging in a 6GH8A won't damage the tube nor the tester. The short test won't be affected, but the merit test might be a little higher. Apply the same technique to other tubes. Another good reference is a tube substitution manual.

AM Antenna Gimmick

My FM reception is great, but on AM I can pick up local stations only. I have an AM/FM stereo receiver which has a built-in loop antenna for AM and terminals for external AM and FM antennas. I have installed an outdoor FM antenna. How can I use it for AM, too?

—H.S., Menlo Park, Calif.

Connect a 6.6 mH RF choke from one of the FM antenna terminals to the AM antenna terminal. This forms a low-pass filter, allowing BCB signals to pass while attenuating vhf (FM band) signals. If the FM band antenna coil inside the receiver has a grounded



center tap, you will need to connect the AM antenna terminal as shown in the diagram. Capacitors C1 and C2 prevent grounding of the antenna system at BCB frequencies. Although the choke causes some FM antenna lead-in unbalance, it should be negligible. On FM, the antenna functions as intended. On AM, the twinlead plus the FM antenna pick up BCB signals. ■

● ● Ever since July 20, 1969, when Astronauts Armstrong and Aldrin took their first moon walk, postal administrations all over the Earth produced special commemoratives to mark the epochal event. Many of them were genuinely spontaneous tributes of nations who wished to postally honor the United States' triumph. This is proven by the fact that designing, printing and release were decided upon only after Apollo 11's success.

● Belgium, for example, did not issue its tribute until Sept. 20, and then kept the face value down to six francs (12¢) which is the normal rate on normal letters mailed to domestic and European destinations.

● The stamp portrays the Apollo 11 team against a background of the moon (the Tranquility landing site is marked) and the exact landing time. So many Belgians used it on their mail post office stocks were exausted in a few weeks. Korea issued five special stamps, all of a modest 20 won (6¢) denomination and showing progress pictures of the mission. India, too, issued a single, low-value stamp for the occasion.

● ● Other postal administrations were not quite so conservative. Their "tributes" comprised long sets with needlessly high face values. Few of them, of course, did any real postal service but were intensively merchandised to the philatelic market.

● Some of the Iron Curtain satellites, who long used Space conquest subjects for designs since 1957, were ready for Apollo 11. Stamps were prepared long in advance and ready for the market within days after the landing—two months before the United States issued the 10-center, the die of which was actually aboard "Columbia" on the half-million-mile flight.

● Romania's comprises a souvenir sheet, imprinted with four 3.30-lei designs showing "The Eagle" and Col. Armstrong taking the first Lunar steps. These are flanked by stamp-shaped

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labels portraying the individual Astronauts and an inscription giving the dates of the entire mission against an outline of the LM.

● Hungary's includes an entire set, but only one of which is for Apollo 11; the others show pictures of previous flights, including some made by Soviets to outer Space.

● What probably is the most striking of all was released by the African nation of Burundi (See page 10, April/May 1970). It is a super-size, 100-franc stamp printed singly on a sheet in such a way that the entire picture spills over into the margins. It shows Neil Aldrin, with camera in hand, walking in front of "The Eagle" and the United States flag as "The Columbia" speeds away for its orbits before picking up the Astronauts later on that memorable July 20.

● The whole is inscribed, "The First Man on the Moon," in French, and date, 21-7-1969 (although the landing was actually made the previous day!)

● And was to be expected, there were those other administrations whose "stamps" are produced by profit-minded promoters, which capitalized on the universally popularity of the event. It made little difference to them that domestic mail service is minimal; their aim was the exploitation of collectors who spend their dollars on the basis of alluring eye- or topical appeal than philatelic sophistication or knowledge.

● In the past they turned out tonnages of stickers honoring every and all American events such as the assassinations of John F. and Robert Kennedy, the death of Gen. Dwight D. Eisenhower, earlier Space flights, etc., so the Apollo 11 flight was right down their alley.

● Togo, Ghana, Dahomey, the Maldives, Panama, Paraguay and Ecuador all had theirs—

Ajman

Belgium

Hungary

Republic of Korea

India

with pictures as fancy as the asking prices. So did the sand-dune sheikhdoms of Arabia, which for years have turning out "stamps" through New York, London and Beirut operators even though they don't have their own postal service but depend upon neighboring administrations to handle the few pieces of mail dispatched by petroleum-exploration company employees.

● Ajman, for example, issued seven stickers and a souvenir sheet, each showing "progress pictures" of the Apollo program from #1 through 12. Later it released huge round adhesives made in similitude of silver coins so they could be foisted on the numismatic market as well as the philatelic.

● Panama's eight labels recall as many flights made by both Soviet and U.S. astronauts since the first Space walk.

● Umm al Qaiwain first took existing label stocks and overprinted them for immediate sale while the presses were busy producing a dozen new ones, each showing a photo reproduction (in gaudy colors) of various phases of the mission from lift-off at Cape Kennedy to landing at Tranquility and the lunar walk.

● They're all pretty and enticing souvenirs of an historic event, but buyers will do well to realize that spending dollars with hopes of future resale profits may not be the wisest decision: catalog editors spurn them; knowledgeable philatelists blacklist them. ■

Dubai

LITERATURE LIBRARY

1. Allied's catalog is so widely used as a reference book that it's regarded as a standard. The surprising thing is that it's free!

2. Now, get the all-new 512-page, fully illustrated *Lafayette* Radio 1970 catalog for CB gear, test equipment, ham gear, tools, books, hi-fi components, etc.

3. Get all the facts on *Progressive Edu-Kits* Home Radio Course. Build 20 radios and electronic circuits; parts, tools and instructions included.

4. Olson's catalog is a multi-colored newspaper that's packed with more bargains than a phone book has names.

5. Edmund Scientific's new catalog contains over 4000 products that embrace many interests and fields.

6. Bargains galore, that's what's in store! *Poly-Paks Co.* will send you their latest 8-page flyer.

7. Before you build from scratch, check the *Fair Radio Sales* latest catalog for surplus gear.

8. Get it now! *John Meshna, Jr.*'s new 96-page catalog is jam packed with surplus buys.

9. Troubleshooting without test gear? Get with it—let *Accurate Instrument* clue you in on some great buys.

10. Burstein-Applebee offers a new giant catalog containing 100s of big pages crammed with savings.

11. Now available from *EDI (Electronic Distributors, Inc.)*: a catalog containing hundreds of electronic items.

12. C. B. Hanson's new Automatic Control records both sides of a telephone call automatically.

23. No electronics bargain hunter should be caught without the 1970 copy of *Radio Shack*'s catalog.

26. Get with 1970's hi-fi jet set. *H. H. Scott* sets the pace with their fantastic line of audio components, some in kit form too!

42. Heath's new 1970 full-color catalog is a shopper's dream. Its 116 pages are chuck full of gadgets and goodies everyone would want to own.

44. Kit builder? Like wired products? *EICO*'s 1970 catalog takes care of both breeds of buyers.

45. CBers, Hams, SWLs—get your copy of *World Radio Labs*' 1970 catalog. Circle 45 now!

48. Hy-Gain's new CB antenna catalog is packed full of useful information. Get a copy.

74. Get two free books—"How to Get a Commercial FCC License" and "How to Succeed in Electronics"—from *Cleveland Institute of Electronics*.

78. Discover how to drive nuts and screws, ream, scribe, pierce holes with *Xcelite*'s Series 99 handles and interchangeable blades.

96. Get your copy of *E. F. Johnson*'s new booklet, "Can Johnson 2-way Radio Help Me?"

100. You can get increased CB range and clarity using *B&K*'s hot "Cobra" transceivers.

107. Want a deluxe CB base station? Then get the specs on *Tram*'s super CB rigs.

111. Get the scoop on *Vers-a-Tronics*' Versa-Tenna with instant magnetic mounting.

114. Prepare for tomorrow by studying at home with *Technical Training International*. Get the facts on how you can step up in your present job.

116. Pep-up your CB rig's performance with *Turner*'s M+2 mobile microphone.

127. National Schools will help you learn all about color TV as you assemble their 25-in. color TV kit.

130. Bone up on CB with the latest *Sams* books. Titles range from "ABC's of CB Radio" to "99 Ways to Improve your CB Radio."

135. RCA Experimenter's Kits for hobbyists, hams, technicians and students are the answer for successful and enjoyable projects.

136. You can become an electrical engineer only if you take the first step. Let *ICS* send you their free illustrated catalog describing 17 special programs.

137. For success in communications, broadcasting and electronics get First Class FCC license. *Grantham School of Electronics* will show you how.

140. Take a gander at *Cornell Electronics*' latest catalog. It's packed with bargains like 6W4, 12AX7, 5U4, etc., tubes for only 33¢.

141. CB antenna catalog by *Antenna Specialists* makes the pickin' easy.

145. Alco Electronic Products has 28 circuit ideas using their remote control relay.

143. Bring new life to your hobby! Exciting plans for new projects. *Electronics Hobby Shop* gives you the dope.

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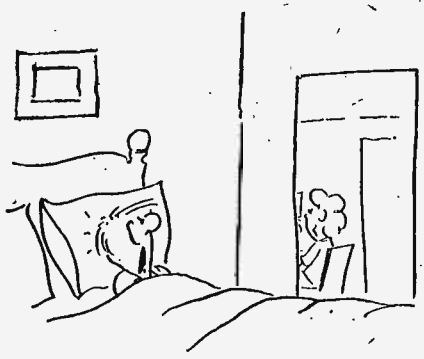
the OM's XYL

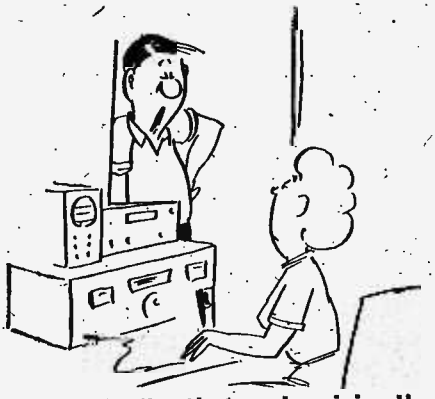
by Buz Holland

"Hold it half a second, Winifred, while I fix Frank's dinner!"

"Now listen, Rhona, I wish you'd stop referring to me as your QRM-OM!"



"Will you please QRT and come to B-E-D!"



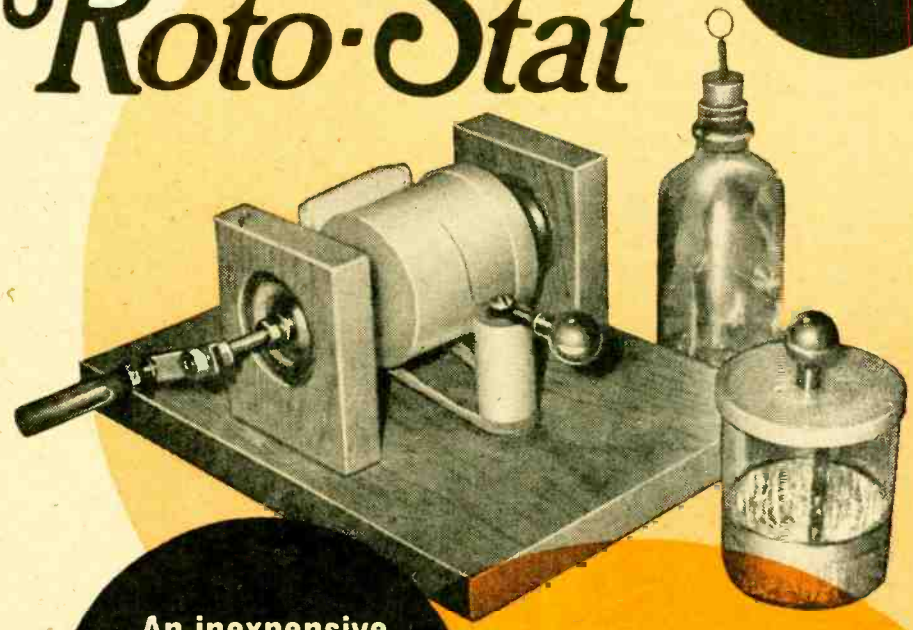
"Do you realize that you're giving the best years of our life to 40 Meters!"

"What we need is more intelligent communication between people in this country!"

"You got as far away as Australia, eh! Too bad you had to come back."

Science and Electronics
JUNE-JULY 1970

Roto-Stat



An inexpensive efficient hand-powered electrostatic generator

From the earliest days of experimenting with electrostatic electricity—say in the 4th Century B.C., when Plato mentioned the wonderful attracting power of amber—electrostatic electricity was produced by laboriously rubbing glass rods or other electrostatic producing objects with dry fur or cloth. In 1663, in Germany, Otto von Guericke used a large ball of sulphur to generate electrostatic electricity by rotating the sulphur ball and rubbing it with his fingers. In 1706, in England, Francis Hauksbee employed rotating glass globes and cylinders to generate static

by Charles Green
W6FFQ

Roto-Stat

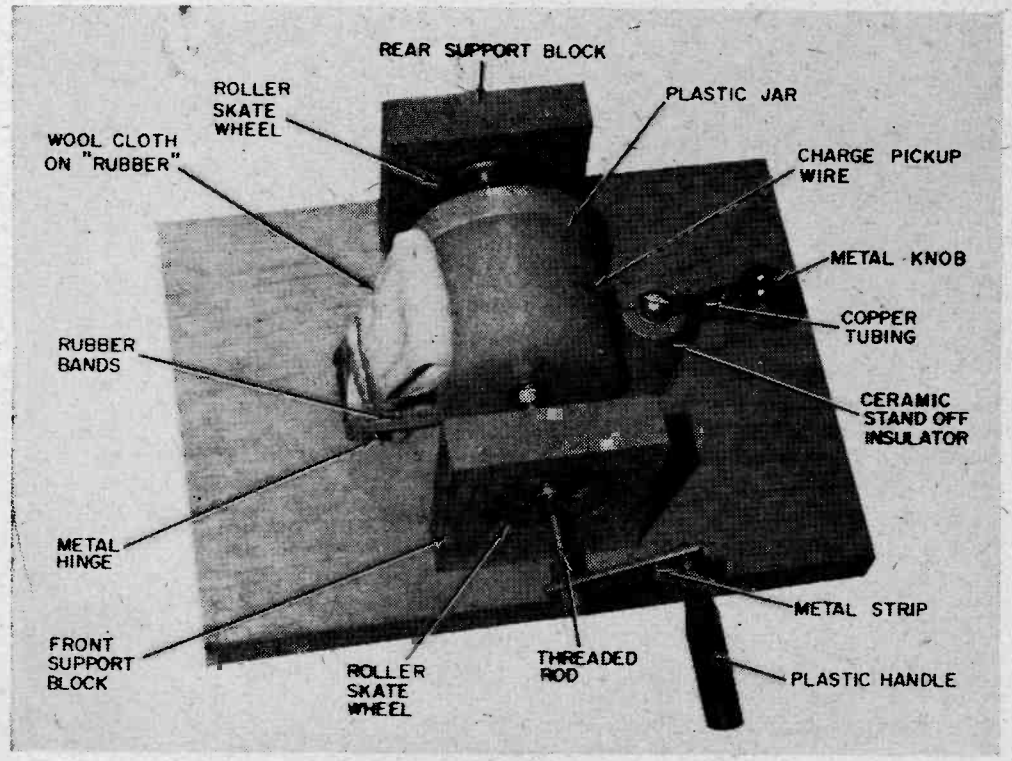
electricity, and he used a metallic conductor to collect the generated static electricity from the generator.

In 1744, in Germany, J.H. Winkler invented a mechanical rubbing device to use in place of rubbing the glass cylinder with the fingers. His *rubber* used a leather-covered cushion pressed against the rotating globe. In America, in 1747, Ben Franklin used an electrostatic generator in some of his electrical experiments; it contained a rotating glass cylinder with a mechanical *rubber*.

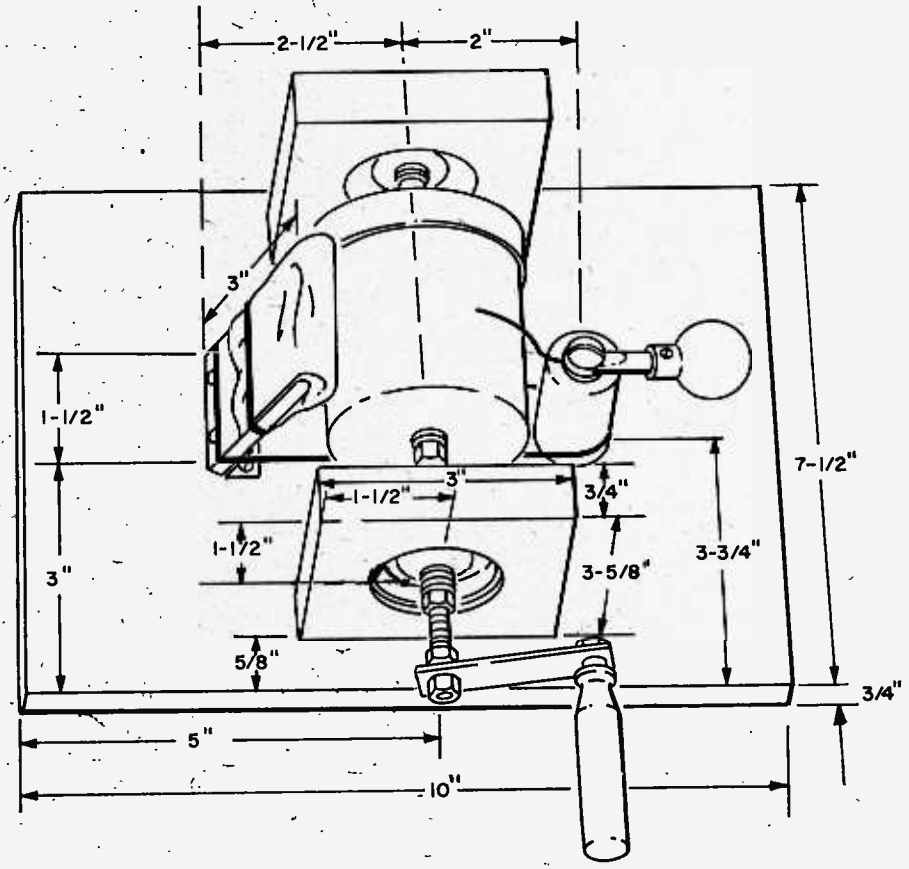
Even in this day and age, electrostatic experiments still fascinate the avid experimenter. You can perform electrostatic electricity experiments by building and using our Roto-Stat electrostatic generator, instead of generating the electrostatic charges by hand-rubbed glass or plastic rods. Our Roto-Stat, designed for easy construction, uses a plastic cosmetic or similar jar in place of a glass ball or cylinder. The generator is built on a ¾-in. white pine base and uses a wool cloth *rubber* and a copper wire electrostatic collector that's formed round the jar.

How It Works. Turning the generator handle rapidly in a clockwise direction causes the wool cloth to rub against the plastic jar's surface. The friction of this rubbing releases electrons which electrostatically charge the jar's surface. As the jar is rotated, the pickup wire mounted on the ceramic standoff collects electrostatic charges from its surface and conducts them to the metal ball output electrode. A Leyden jar can be charged by contacting its terminals to the metal ball output electrode and ground. (For complete construction details for a Leyden jar and an electroscope see *Ben Franklin's Leyden Jars,* Dec./Jan. 1970 SCIENCE AND ELECTRONICS.)

Plastic Power. We used a plastic jar 2¾-in. high x 2¾ in. diameter with plastic screw top for the rotating element of our Roto-Stat. If another size plastic jar is used, scale the dimensions of your unit proportionately. Since different types of plastic vary in their ability to generate electrostatic electricity,



Our Roto-Stat electrostatic generator, though not as huge as original ones built in early 18th Century, is quite efficient. From details in photo and drawing you can build it.



MATERIALS LIST FOR ROTO-STAT

1—Ceramic (L5 glazed) standoff insulator, threaded at both ends, 2-in. high x 1-in. dia. (JAN type NS5WO416, E.F. Johnson 135-503, or equiv.)

1—Hard rubber of plastic handle, 2-in. long x ½-in. dia. (we used handle from radio aligning tool)

1—1½ x ½-in. metal hinge

1—Plastic jar with screw-on or snap-on plastic lid, 2¾-in. high x 2¾-in. dia. (you may also want to use this size for Leyden jar and electroscope—see text)

2—Metal knobs, approx. ⅞-in. dia. (available as automobile dash control or seat control knobs at auto parts stores)

1—2¼ x ½ x ⅛-in. metal strip for mounting handle

1—NE2 neon lamp

2—Roller skate wheels, ball bearing (available as replacement wheels at toy stores and toy counters in department stores)

1—Threaded metal rod, 8-in. long x ¼-in. dia.

Misc.—1½ x 4-in. wool cloth strips, wood screws, nuts and washers for threaded rod, screws to fit ceramic insulator, cement, rubber bands, #18 to #22 bare copper wire, ¾-in. thick pine for base, etc.

test the jar you've selected by rubbing it with a wool cloth and noting whether the jar attracts small pieces of paper when the jar is moved over them. If it doesn't, try a jar made of different plastic material.

Any type of soft wood can be used for the base. Just make sure that the wood is clean and dry. The dimensions given in our drawing are approximate, to serve as a guide. Any size generator unit can be built, but for best results it's suggested you follow the general layout of our unit.

Begin construction by cutting a 7½ x 10-in. base of ¾-in. thick pine or other soft wood, then cut two 3⅝ x 3 x ¾-in. wood blocks. Roller skate wheels, available as replacements at most hardware or bicycle shops, are used as driveshaft bearings. Cut a hole in each wood block to fit roller skate wheel used for this purpose. The hole in each block of our unit is made just large enough to force-fit the wheel into the hole in the

Roto-Stat

block. Duco cement or Elmer's Glue is used to hold the wheel securely in place. You may prefer to use long sheet metal screws through the sides of the mounting blocks to hold the wheel.

Cone Or Cylinder. Drill holes in the center of the bottom of the plastic jar, and also its lid, to fit the ⅜-in. threaded metal rod. Cut and drill a conical wood section to fit inside the plastic jar if the jar isn't straight-sided (if it is, then you'll need a wooden cylinder), extending from the jar bottom to the jar lid for internal support. A clearance hole for the metal rod, which serves as the axle for the jar, is drilled through the center of this wooden block.

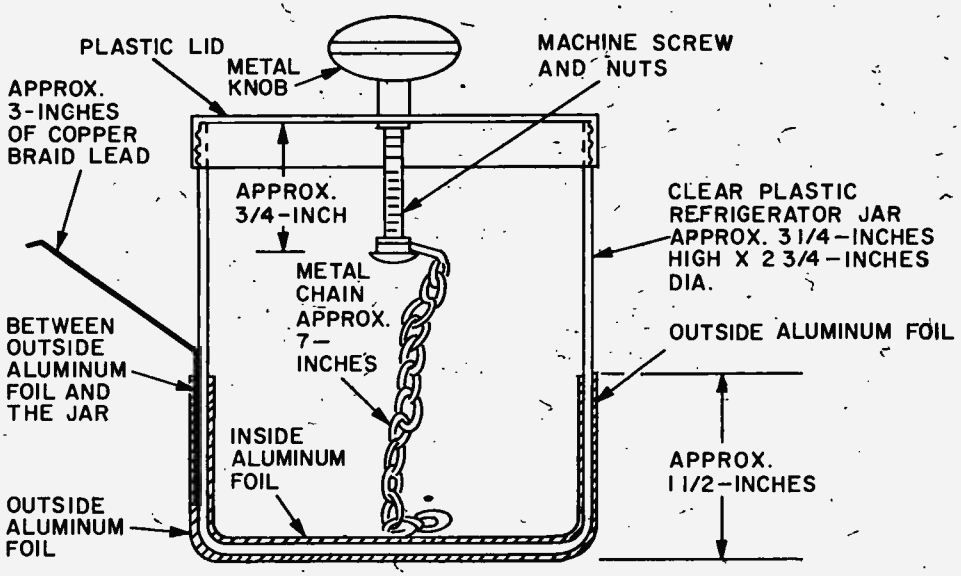
Mount front supporting block on the base as shown in our drawing. We used two wood screws through the base to hold the block to the base. Insert threaded metal rod through jar and skate wheel bearing and hold them in position on the rod with a nut and washer top and bottom of the jar and on either side of the bearing mounted in the wood block. Don't tighten the nuts now; you'll probably reposition the jar.

Position the rear block-mounted bearing on threaded metal rod with a nut and washer on both sides of the bearing. Adjust spacing of nuts on the metal rod so that the jar is in the center of the base as shown in photos and drawing. Position the rear wood block so that metal rod and jar can turn freely without binding, and fasten this block in position to the base with wood screws. Make sure that about 1¾ in. of metal rod projects out from the front bearing for attaching the metal strip that holds the handle, then tighten nuts against the jar and bearings.

Plastic Handle. We made the plastic handle from an alignment tool and bolted it to a 2¼ x ½ x ⅛-in. metal strip with washers to allow the handle to rotate freely. Fasten a 3 x 1½ x ¼-in. piece of plywood to a hinge, and mount the hinged plywood section to the wood base adjacent to one side of the jar. Mount a 2-in. high x 1-in. diameter ceramic standoff to the base on the opposite side of the jar as shown in our drawing and photos.

Mount a small unpainted metal knob onto a piece of copper tubing, flatten the free end of the copper tubing, and mount it on

About Leyden Jars and Electroscopes


PLASTIC LID
METAL KNOB
MACHINE SCREW AND NUTS
APPROX. 3-INCHES OF COPPER BRAID LEAD
APPROX. 3/4-INCH
METAL CHAIN APPROX. 7-INCHES
CLEAR PLASTIC REFRIGERATOR JAR APPROX. 3 1/4-INCHES HIGH X 2 3/4-INCHES DIA.
OUTSIDE ALUMINUM FOIL
BETWEEN OUTSIDE ALUMINUM FOIL AND THE JAR
INSIDE ALUMINUM FOIL
APPROX. 1 1/2-INCHES
OUTSIDE ALUMINUM FOIL

Even though we used materials found either in kitchen or bathroom this Leyden jar can store electrostatic charge generated by our Roto-Stat, so be sure it's discharged when stored.

the ceramic standoff. Also fasten a length of #22 or larger copper wire to the ceramic standoff and bend it so that it curves around the jar for a length of about 1½ in. but doesn't touch it. Position the wire approximately 1/16 in. away from the jar's surface and cut off the excess length of wire. Small rubber bumpers are fastened to each of the corners on the bottom of the base.

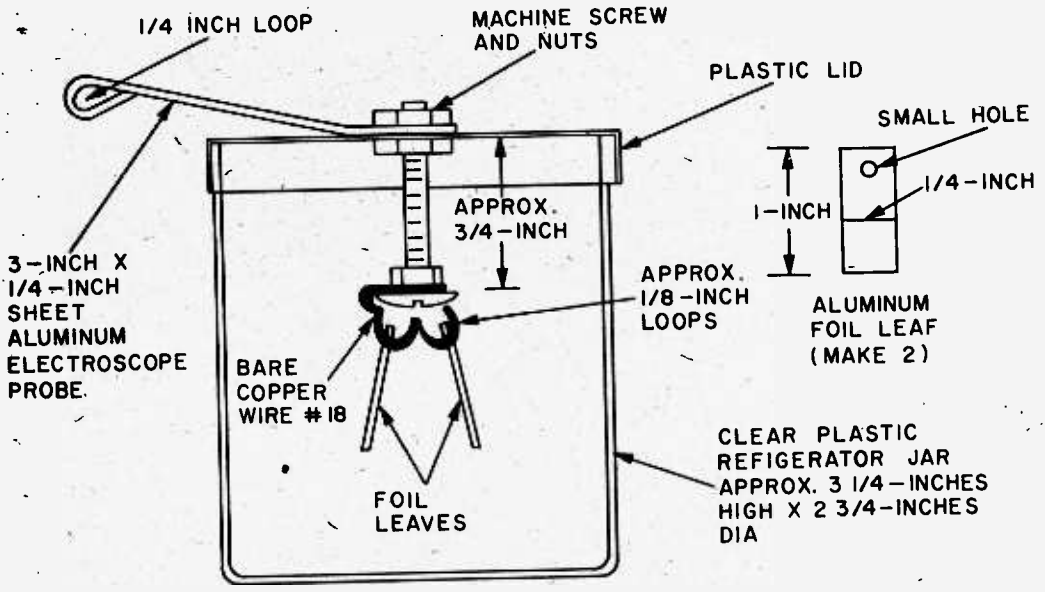
Fold a piece of clean, dry wool cloth over the top end of the hinged plywood piece, holding the cloth in place by means of a rubber band. Clean the surface of the jar carefully. Place several rubber bands around the base of the ceramic standoff and stretch them 'round the bottom of the hinged plywood section so that the wool cloth that is folded over its free end will be seated firmly against the side of the jar.

Rotate the jar by turning the handle, making sure that the jar turns freely, but with a slight resistance from the wool cloth *rubber*, and that the pickup wire does not touch the surface of the jar. Do not touch the surface of the jar or the wool cloth after the jar has been cleaned, because of the possibility of transferring moisture on your hands to either or both.

Experiment 1. Before performing any experiment, make sure that both the cloth on the *rubber* and the jar's surface are clean and dry. If necessary, expose both cloth and jar to the rays of a heat lamp to dry up any moisture. These experiments may not work as well, or may not work at all in a humid area, since a dry environment is necessary for best results. We suggest you perform them in an air-conditioned room if at all possible for driest atmosphere.

Rotate generator handle rapidly in a clockwise direction, and hold the electroscope so that its electrode makes contact with generator's metal ball. Observe that the electroscope leaves deflect away from each other. This indicates that the electrostatic generator is operating and producing an electrostatic output voltage.

Experiment 2. Connect the outer foil of a Leyden jar to ground or a large metal object, and bring the Leyden jar top electrode in contact with the generator metal ball. Rotate generator handle rapidly in a clockwise direction for a few minutes, then move the Leyden jar away from the generator. Make sure you do not touch Leyden jar top electrode with your fingers. Carefully disconnect the Leyden jar outer foil lead from the ground. Then move the outer foil lead very



You'll want an electroscope to reassure you that your Roto-Stat is actually generating current before you start each experiment. It's easy to build and well worth the effort.

close to the top electrode. Note that a small spark will jump between the top electrode and the outer foil lead of the Leyden jar. This indicates that the Leyden jar was charged with the electrostatic output voltage from the generator.

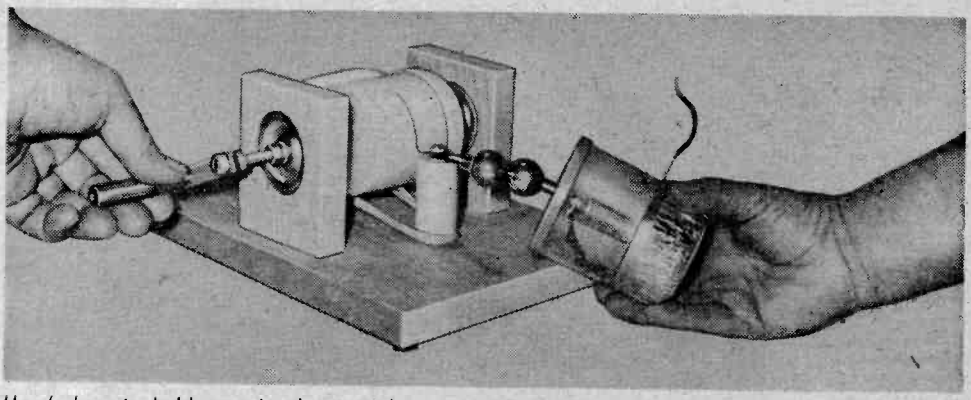
Repeat the experiment, except connect a VTVM (preferably with a high voltage probe) between the Leyden jar outside foil and its top electrode, after Leyden jar has been charged. Fasten one lead to ground strap and touch top electrode with the other lead of the VTVM. Observe that the VTVM momentarily indicates a large negative voltage. This shows that the generator has a negative electrostatic output voltage.

Experiment 3. This experiment requires a dimly lit area in order to best see the neon lamp. Rotate generator handle rapidly in a clockwise direction, and momentarily bring one lead of an NE-2 neon lamp in contact with the generator metal ball while you hold the other lamp lead. The neon lamp should flash momentarily, indicating that the generator is operating.

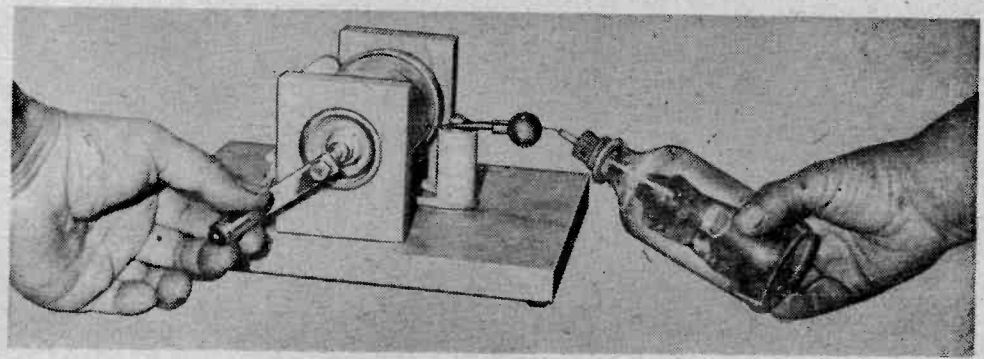
Move one of the neon lamp leads around the surface of the rotating plastic jar. Note that the neon lamp flashes, indicating the electrostatically charged areas.

Remove the neon lamp lead from the jar, rotate generator handle rapidly for a minute, and then stop. Now move neon lamp lead around on the surface, noting that the neon lamp still flashes, indicating that the electrostatically charged areas on the plastic jar will remain active for a period of time after the surface of the jar is excited by rubbing.

Try different types of cloths for the *rubber* in place of the wool cloth and compare their operation with that of a wool cloth. Note rotation speed affects size of charge. You can also try different configurations of the wire collector. ■

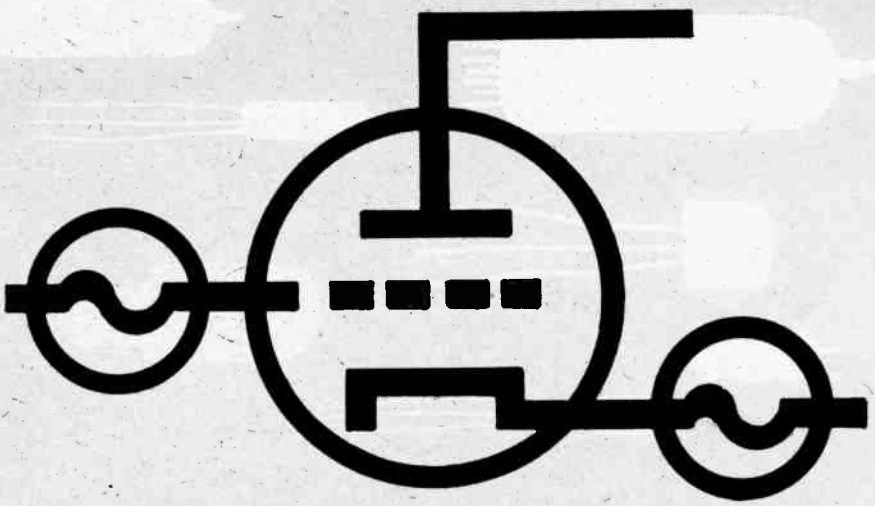


Here's how to hold your Leyden jar when you charge it from your Roto-Stat. Keep two metal balls in constant contact while turning handle to generate charge.



If there's a doubting Thomas amongst those you're showing your Roto-Stat, prove it's generating by placing Electrostat's collector against Roto-Stat's output ball.

the riddle of the FOLLOWER FAMILY



Or, who in his right mind would stick by a circuit that provides no voltage gain whatever?

by Norman Crawford

Everybody knows that in electronics, the name of the game is *gain*, or *amplification*. That's why all electronic equipment is filled with vacuum tubes and transistors, which give the amplification needed to make the various circuits work. Hooked up properly, each of these devices can turn microvolts into millivolts, or millivolts into volts. Result is that a tiny signal from a microphone or stereo cartridge can drive a loudspeaker with room-filling sound.

Yet, tucked away in the corner of a great many electronic circuits, we find transistors and tubes hooked up so as to give no voltage gain at all. In fact, they give a loss! A volt of signal applied to the input of such a circuit gives *less* than a volt out! What are these devices? What is their excuse for being? In short, why bother with something that costs money and takes up chassis space, yet gives no voltage gain in return?

C, E, Or S. The general name for these devices is *voltage follower*. This is because the signal voltage coming out of such a device *follows*

FOLLOWER FAMILY

(in other words, moves in step with) the input voltage.

If built with a vacuum tube, the device is called a *cathode follower*, because the cathode voltage follows any signal impressed on the grid. A very similar circuit using an ordinary junction transistor is called an *emitter follower*. In this circuit, the emitter voltage follows the signal on the base. And, in the new circuitry using field—effect transistors, we are seeing more and more *source followers*, where . . . you guessed it . . . the source voltage follows a signal impressed on the gate.

These three circuits, which are all basically very much alike, are diagrammed as shown in Fig. 1 below:

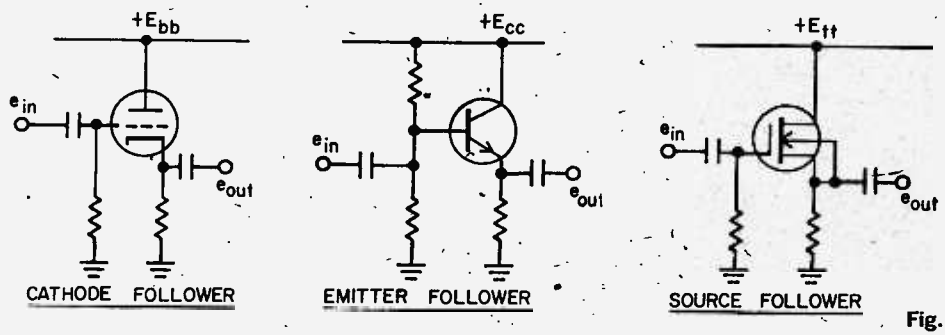


Fig. 1

In each of the above circuits, a 1-volt signal at the input gives less than 1 volt out. At first glance, then, it would seem that the designer would be wiser to replace the whole circuit with a piece of wire! What motivates people to go to all this trouble just to lose signal voltage?

Hidden Ts. One of the standard answers to this question is that the Follower Family, like a transformer, gives *impedance matching*. A transformer, as you probably know, can act as an impedance magnifier. For example, if you have an amplifier designed to drive an 800-ohm load, and you want to drive an 8-ohm load instead (a speaker, say), you can use a transformer with a 10-to-1 turns ratio to magnify the 8-ohm load to look like 800 ohms. The amplifier, looking at the speaker through the transformer, sees the 800-ohm impedance it was designed to drive (see Fig. 2).

Can an emitter follower do this? Certainly, if you use a transistor with a beta (current gain) of exactly 99. The impedance magnification of an emitter follower is found by adding 1 to the current gain. This means that a transistor with a beta of 99 will provide a 100-to-1 impedance magnification—see Fig. 3. (Don't rush out and build this circuit; we're talking about concepts, not design. This explanation ignores a few essential items, such as the need for bias networks and for keeping DC out of the speaker.)

One practical problem is immediately visible. You can't buy a transistor with a beta guaranteed to be 99. The best guarantee you can usually get is that beta is ". . . more than 25 . . ." (how much more?); or ". . . between 60 and 350 . . ." In other words, you can't impedance match *accurately* with an emitter follower. Could there be some other reasons for its widespread use?

The Es And Is. You guessed it—there are. And you can see one of these reasons when you examine the current relationships in the above circuit. When we say that a transistor has a current gain of 99, we mean that for 1 mA flowing into its base, it will draw 99 mA into its collector (see Fig. 4).

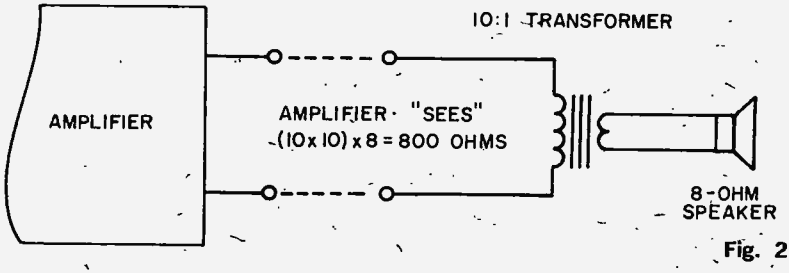


Fig. 2

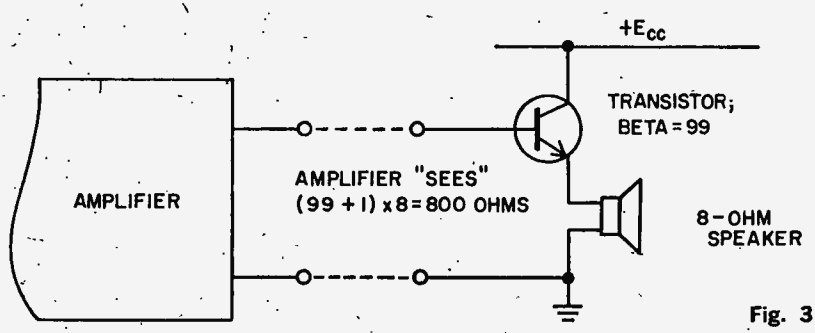


Fig. 3

From our sketch, it's apparent that the load resistor has 100 times more current flowing in it than flows into the base. An emitter follower doesn't give voltage gain, but it's pretty clever when it comes to *current* gain! Any transistor worthy of the name can rack up a sizable current gain when connected as an emitter follower.

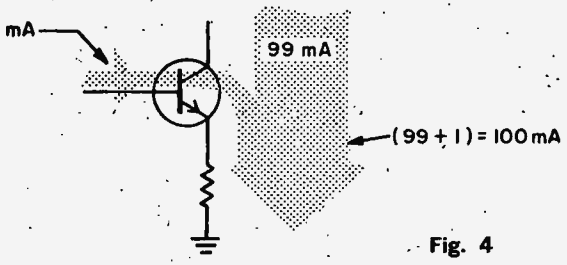


Fig. 4

Another reason for using emitter followers is revealed if we examine the power relationships of both transformers and emitter followers. Power, after all, is the product of *voltage* and *current*. In a transformer which steps voltage *down* 10 to 1, the current is stepped *up* 10 to 1. The voltages and currents of a transformer are on a see-saw; as one is stepped up, the other goes down in proportion. Therefore, the transformer's output power is the same as its input power (assuming no power is lost inside the transformer)—see Fig. 5.

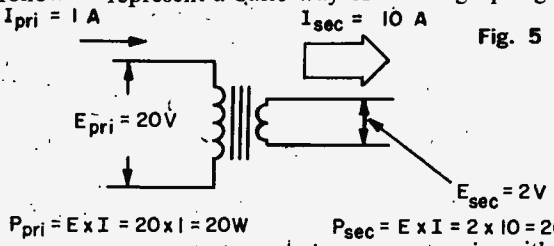


Fig. 5

Power Gain! In an emitter follower, however, the output current is made larger than the input current—stepped up, in transformer language—*without* a corresponding step down in voltage. (Remember, the output voltage follows the input voltage, and is nearly identical to it). Therefore, the power output of an emitter follower is considerably greater than its power input. In brief, it has *power gain*, something no transformer can boast of. (See Fig. 6).

To judge a member of the Follower Family solely on its voltage-gain capabilities is like judging a submarine on its ability to fly. Voltage gain is the one ability a follower does *not* have; where it really shines is in its ability to provide *current gain* and *power gain*.

The Follower Family—cathode-followers, emitter-followers, and source-followers—represent a basic way of hooking up a gain-giving device to give current gain without voltage gain. There is another family, called grounded-grid, grounded-base, and grounded-gate, which gives voltage gain without current gain. However, that's a story for another day. ■

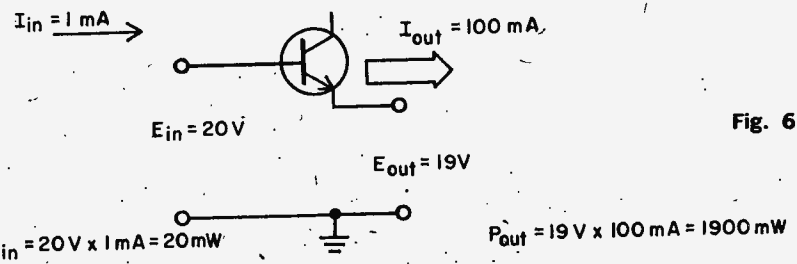
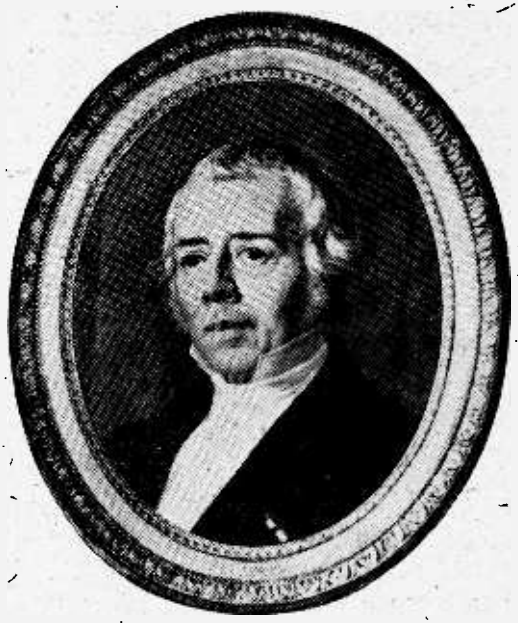


Fig. 6

H. C. Oersted—the man who linked electricity and magnetism

GREAT MEN OF SCIENCE



by Webb Garrison

THE 1819-20 academic year got off to a very bad start. All over Europe, educators shuddered when they heard that German universities had been placed under State supervision and that freedom of the press had been abolished.

Fortunately, things were better in Denmark. A man was still free to teach and publish without interference.

Standing before a handful of advanced students who were being introduced to the mysteries of electricity, Prof. Hans Christian Oersted brushed his long hair out of his eyes. He peered over his big nose and promised: "Now, young gentlemen, you shall see something remarkable!"

To the best of his knowledge, no member of the class suspected that electricity can cause a wire to glow. Oersted had attached a fine length of platinum to the terminals of a battery; within seconds, it should begin to heat.

As the wire became pink and then white-hot, students made appropriate noises to express their amazement. Their professor reached to move a small compass away from his apparatus and in the process drew the instrument under the glowing wire.

He stared, stuttered, and forgot the rest of his lecture. Hastily dismissing the class, he repeated the movements made earlier—and saw that the needle of the compass really did waver toward the Mediterranean Sea when drawn underneath the electrically-heated wire.

Here was something new under the sun—a clear demonstration of a long-suspected but never discovered relationship between electricity and magnetism. A more powerful battery should cause greater deflection; tested, it showed just that effect. Eight different conductors of electricity were tried; in each case a flow of current through a wire caused a magnetized needle to change its position.

Though he didn't yet know what to call it, the Danish scientist had stumbled upon the phenomenon of electromagnetism. By July 21, 1820, he had completed a sonorous Latin tract describing his findings. Ambiguous language of the report makes it impossible to be absolutely sure of circumstances surrounding his discovery. Weight of evidence, however, favors chance—chance fed by 13 years of ceaseless inquiry into the riddles of electricity.

Oersted's little pamphlet *Experimenta Circa Effectum Conflictus Electrici in Acum Magneticam*, was drab and unprepossessing in appearance. But when circulated among the scientists of Europe it created a sensation. He was made a knight of the order of Danebrog, received the Copley medal from

(Continued on page 102)

Cal-Trace

by Homer L. Davidson

Disciplining the signal injector makes it an inexpensive signal generator

No, it's not a miniature, radio-controlled rocket launcher, though at first glance a non-technical person may misconstrue it to be one.

Heart of our *Cal-Trace* is the EICO model PS1 Signal Injector probe. It's a pocket-sized, self-powered generator that's extremely handy for locating the faulted portion of an electronic circuit, be it a transistor radio, a hi-fi system, a tape recorder, a TV set, a CB rig, etc. The signal the PS1 generates is so rich in harmonics that it covers RF, IF, and audio ranges.

There's only one problem: as you move from stage-to-stage, starting from the speakers and working back towards the input, the build-up in signal level in your progression from stage-to-stage may be such that before arriving at the antenna or the input, a point is reached where this relatively large signal blocks the device. This creates a false impression as to where the trouble really lies.

An easy way to solve this problem is to use an attenuator to control the output level of the signal injector. We've gone one step further by providing a calibrated scale on the attentuator. This is a big help in determining first if a particular stage actually has gain and then in giving a relative value to the

Cal-Trace

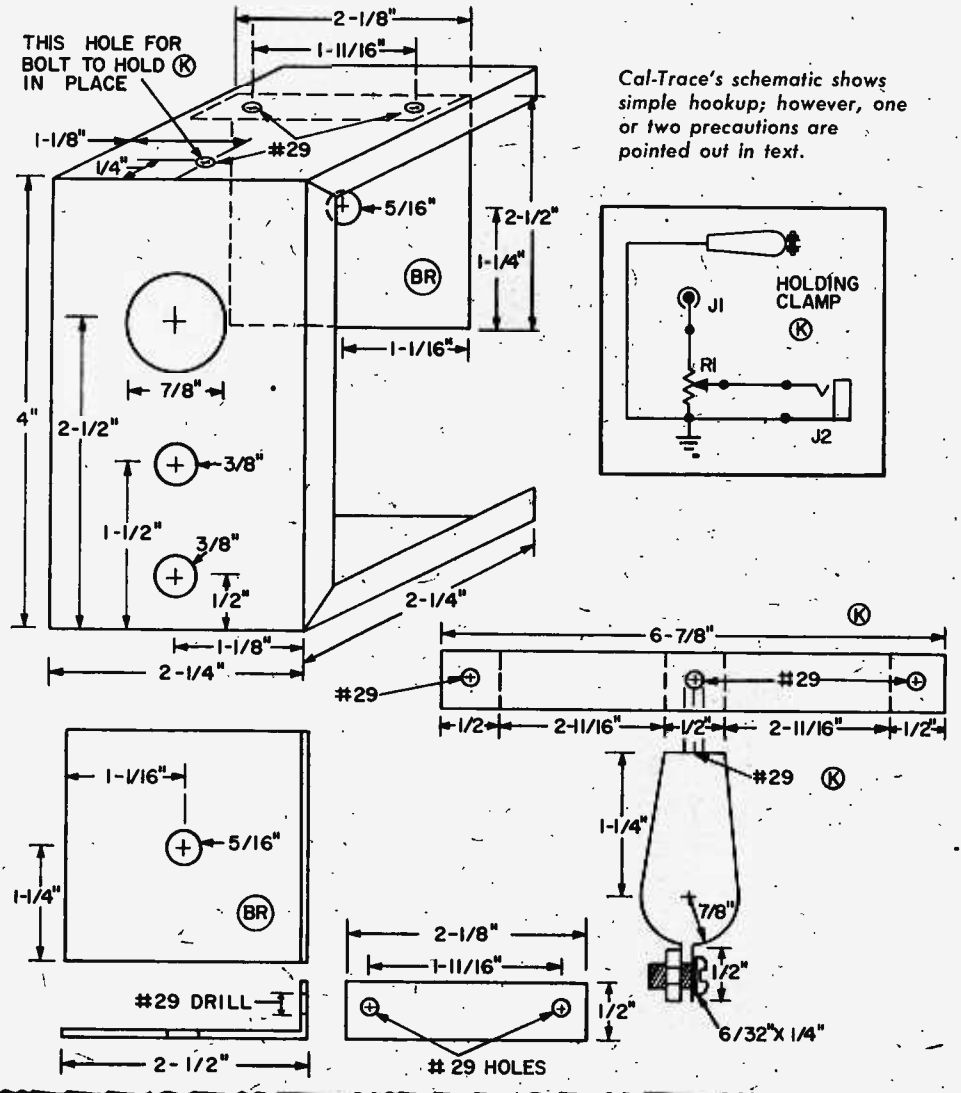
measure of the amount of gain in the stage. The combination of PS1 with an attenuator is an easy way to make an inexpensive signal generator.

How To Make It. *Cal-Trace* is such a simple device that you should be able to build

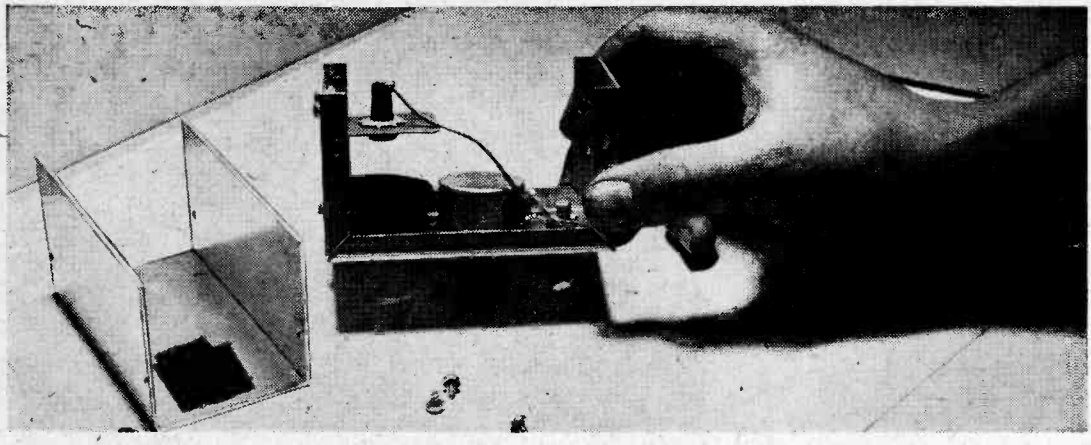
PARTS LIST FOR CAL-TRACE

J1—Tip jack (Lafayette 32E65113 or equiv.)
J2—Open circuit phone jack (Lafayette 99E62135 or equiv.)
P1—2-conductor phone plug to fit J2 (Lafayette 99E62218 or equiv.)
P2—Phono needle test prod (Lafayette 32E65089 or equiv.)
R1—1000-ohm, linear taper potentiometer (Lafayette 33E11149 or equiv.)
1—Dial plate (Lafayette 30E40953 or equiv.)
1—2¼ x 2¼ x 4-in. minibox (Lafayette 12E83704, 12E83878 or equiv.)

Misc.—Scrap aluminum strip ½ x 6⅞ in. for clamp K (could be brass or phosphor bronze), hookup wire, solder, screws, nuts, etc.



Cal-Trace's schematic shows simple hookup; however, one or two precautions are pointed out in text.



This innards view easily locates all parts needed to make Cal-Trace. You can see how tip jack is centered over spring clamp that holds signal injector.

it in little more than an hour. It's housed in a 2¼ x 2¼ x 4-in. minibox. Mark centers of holes on the front panel and top of box, then, being careful not to mar the finish of the minibox, drill and de-burr all the holes. Mount the potentiometer and its knob and calibration scale as well as the phone jack J2 on the front panel.

Make a bracket (Br) to fit inside the box on which tip jack J1 is centered. The tip jack makes contact with the output probe of the signal injector and also helps to hold it in position, centered in the hole in the front panel. Make spring clip (K) from an aluminum strip; a scrap of about the same thickness as the minibox will do nicely. Form it as shown in our drawing so that it grips the signal injector body snugly yet permits its free insertion and extraction when required. Mount the clip on front panel as shown in the assembly drawing.

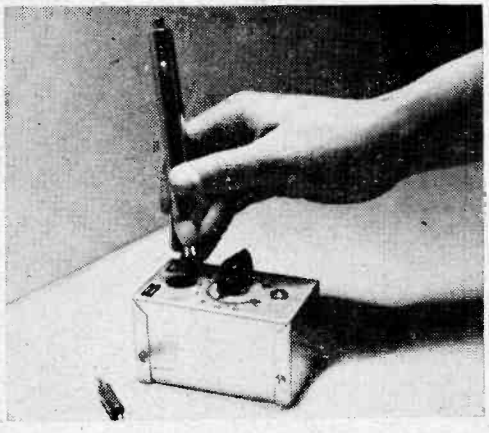
Output test lead is made from two lengths of hookup wire approximately 3 ft. long. A phone plug to fit the J2 jack is connected to one end of these leads. On the opposite end of the lead connected to the sleeve of the plug, fasten an alligator clip. Fasten a standard test lead prod to the free end of the other lead, connected to the tip of the phone plug.

Wire the unit as shown in the schematic, taking care to connect the arm of the potentiometer (center lead) to J2 and the high side of the potentiometer (lead to the left when looking at the rear) is connected to J1. When mounting the spring clip to the panel be sure to remove any paint that may prevent metal-to-metal contact. This point is the ground return for the signal injector. Now that you have completed this easy wiring and assembly you're ready to use *Cal-Trace*.

How To Use It. We'll just give the basics. Certainly you'll be able to go on from these and devise many ways to use this very handy service instrument.

Place the PC1 signal injector in its holder through the panel of *Cal-Trace*, being sure that its probe is firmly seated in J1, and plug in the test leads. Connect the alligator clip to the ground (in most instances the chassis) of the device you want to test and turn the probe on by locking its battery switch in the *on* position. Set the calibration control on its highest point for maximum signal.

Starting at the speaker, touch the probe of the test leads first to the speaker and then to the input of each stage from the speaker



It's easier than threading a needle—just put the signal tracer in place and you're ready to check gains, trace circuits, etc.

Cal-Trace

until you reach the antenna or input. It might be wise to try the unit out first on a set that is working so you get the hang of it and get some idea as to how much, approximately, to reduce the control as you proceed back to the input. Now try a defective receiver. When you reach a faulted stage you will no longer hear the signal. Remember, you need maximum signal at the speaker for the gain of that stage. Bear one thing in mind: the lower the signal from the injector, the easier it's going to be to determine whether or not a particular stage is functioning properly.

You can measure the relative gain of a stage by comparing the setting of the control under test with the setting to give constant output for the preceding stage. If you require more attenuation to maintain constancy of output it is obvious that the stage under test is functioning and that it is increasing the signal level in proportion to the amount of attenuation you have inserted to maintain constancy of output. This will be true for all amplifier stages.

If you cannot tune in a station on a receiver but can get the injector signal through from the antenna, then, most probably, the oscillator of the receiver is not working.

Defective transistors can be checked by injecting the signal first to the base and then to the collector. If no signal is heard from the base but is heard from the collector, the transistor is defective.

The same procedure can be followed in checking coupling capacitors, especially the tiny electrolytic types in transistor circuits. If the signal is weak or non-existent on the input side but normal on the output side of the coupling capacitor it should be replaced. These are just a few tips on how to use *Cal-Trace*. As you gain experience with it you will devise your own methods to use it to best advantage. ■

A TREAT FOR TIRED TICKERS

A mechanical "heart helper" that can be completely implanted within a patient's chest to ease the load on his natural heart has been successfully tested in animals. Batteries for the device were specially adapted for the purpose by the General Electric Research and Development Center and the company's Battery Business Section.

In the system under development, electric power for the pump would normally be supplied from external sources. The batteries would automatically take over whenever the patient needed to be disconnected temporarily from the external source —when moving from one room to another, for example.

Unlike earlier systems, the battery-equipped device has no tubes or wires penetrating the patient's skin. Electricity from the external source is supplied through a flat metal plate placed over the patient's chest and located opposite a similar plate implanted beneath the skin—in effect, a transformer. ■

AN XYL'S HANDBOOK, OR

How I Learned To Live With a DXer and Love It!

by Arlene Jensen

WOMEN'S magazines regularly shed sympathetic tears for the poor "golf widow," who must mow the lawn while hubby is out digging divots on the Country Club back nine. Psychiatrists study the "Saturday Syndrome," the mental plight of wives banished to the kitchen while their men, sofa-sprawled, watch the Game of the Week on TV.

But what about the forgotten legion of lonely women married to America's shortwave addicts? Not a word has been written about the care and feeding of a DXer. Nobody ever tells you how to amuse yourself while sitting in the dark because your husband thinks the fluorescent light causes QRM. How does one keep her sanity when the OM has obviously lost his to the magic box he calls his receiver?

Take the word of one XYL, it's tough! But it can be done. Here are a few tips on how to live with a radio nut.

First and foremost in this crash course is learning the jargon. Calling his receiver a radio is something akin to asking an admiral about his boat. Do make an attempt to learn the meaning of words like veries and propagational disturbances. If you can keep a civil tongue in your head when he talks about a triple-conversion, solid-state superhet, score an A on this one.

Refrain from comments like, "How can you hear anything with all that noise?" Or, "Why don't we go anywhere anymore?"

When he makes wistful sounds about a new $500.00 receiver, smile. You've got to admire a guy who can be so picky about the money you spend on clothes, then become a financial genius when he

XYL'S HANDBOOK

wants to find room in the budget for a Hammascratcher SPX-3000A.

Get acquainted with other DX widows. They're the only people who can *really* understand your problem. The slogan of one such group I know is, "We also serve who only sit and complain." Honest!

Here are a few more handy tips:

• When the neighbors demand to know the reason for the strange-looking wires on the roof, tell them it's a clever device to trip bats.

• Never—but never—accompany him to a DXers convention. I mean, can you imagine a roomful of them sitting around talking about transpolar auroral flutter?

• Learn to ignore the suspicious glances you get from the postman when he delivers a QSL from Peking. After seeing all the

strange mail you get, he's sure you belong to a subversive group.

• Never touch his gear, even if the dust is an inch thick. One XYL suggested slip-covering the monster, and she hasn't been heard from since.

An SWL's nocturnal habits deserve a word, too. Never sneak up behind when he has his headphones on. If you want his attention, just stomp on the floor until his receiver vibrates. This is most effective after midnight.

Buy an electric blanket. This is an absolute must on cold nights when you wake up to find he's deserted his half of the bed in favor of a pre-dawn newscast from Ulan Bator or a rare Panamanian sign-on.

Try to get the baby's night feeding to coincide with your DXer's night patrol of the shortwave bands. After all, he needs only his *ears* to listen and he might as well be doing something constructive—like warming a bottle—with his hands.

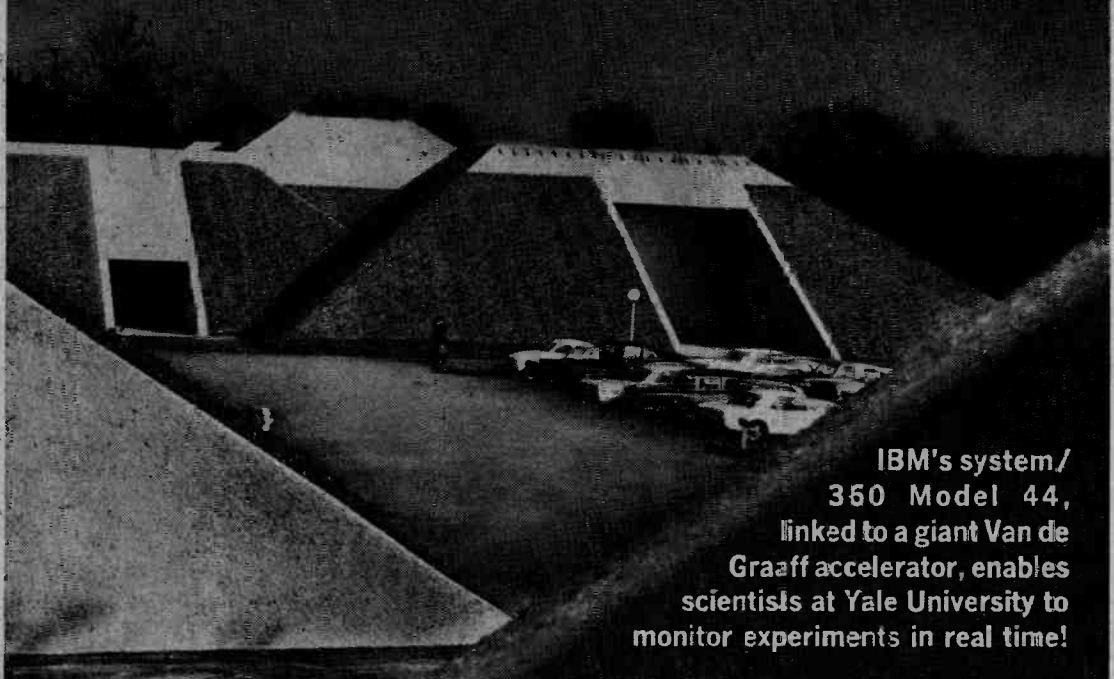
And practice looking impressed. This will come in handy when he wakes you up at 4 a.m. to tell you he's just logged Radio Bougainville.

A little T.L.C. (that's Tender Loving Care, as if you didn't know) goes a long way. If you really want to turn him on, lift his right earphone and tenderly whisper, "Dinner will be served at 2330 GMT, dear."

DXers are lovable weirdos, so let's be fair. Anyone who can name the capitals of 142 different countries, understand a smattering of Swahili and Serbian, identify the national anthem of Lesotho, and fix the TV set when it gets a bad case of flip-flops, can't be all bad.

So, grin and bear it. And when he signs your anniversary card, "73" . . . you expected maybe 88, squared? ■

THE EMPEROR'S COMPUTER



IBM's system/360 Model 44, linked to a giant Van de Graaff accelerator, enables scientists at Yale University to monitor experiments in real time!

At Yale University, in an earth-shielded concrete building that resembles a Mayan pyramid, physicists bombard a variety of materials with high-speed ions. Their goal: to understand more fully the structure and behavior of the atomic nucleus.

Part of Yale's A. W. Wright Nuclear Structure Laboratory, which is directed by Dr. D. Allan Bromley, the building houses a giant tandem Van de Graaf accelerator. Called, the Emperor, this Van de Graaf produces the most energetic particles yet obtained with an electrostatic accelerator.

The main part of the accelerator is an 81-ft.-long tank with a bulge in the middle that makes the tank look much like a submarine. Within the bulge is a cylinder-shaped positive electrode that can be given a maximum potential of 12 million volts. Outside one end of the tank is an ion source, which projects a beam of negative ions into the tank and along its axis, where the ions are accelerated toward the positively charged cylinder.

As the ions move through the cylinder, they pass through a gas-filled stripping canal, where electrons are removed by collision with gas molecules. Removal of the electrons gives the ions a positive charge, so that upon leaving the cylinder they are repelled from the positive electrode and accelerated again, on toward the other end

Facts and photos courtesy IBM's Computing Report magazine

EMPEROR'S COMPUTER

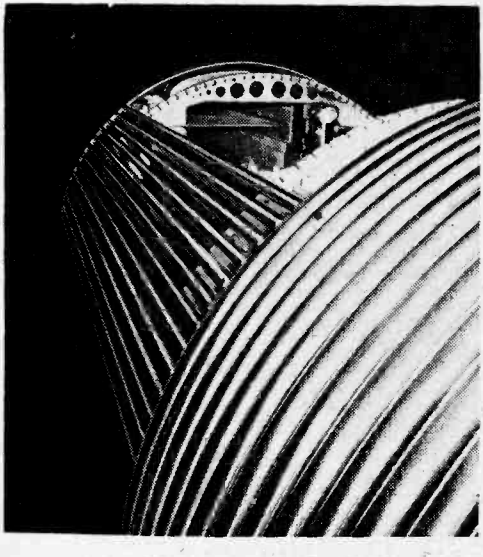
of the tank—hence the designation "tandem Van de Graaf."

Focused by Magnets. When the ions leave the far end of the tank, the energy of each ion is proportional to twice the voltage of the central electrode in the case of protons, and higher in the case of ions from which several electrons have been removed. Focused by magnetic lenses, the ion beam can be directed to targets in any of three experiment rooms in the Nuclear Structure Laboratory.

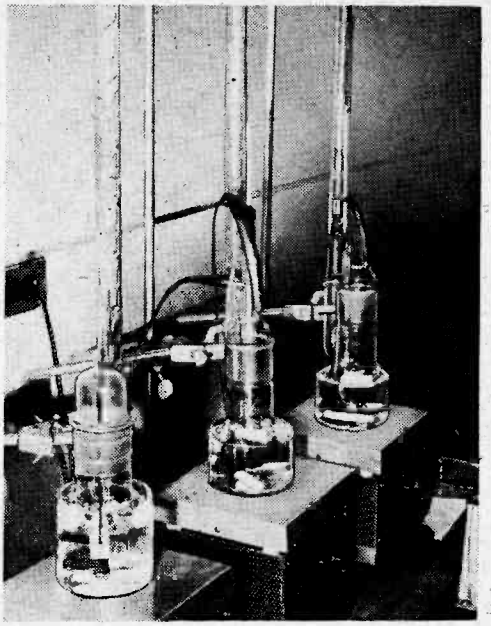
A target is composed of whatever substance a physicist wants to study. The ion beam scatters upon striking the target—or, more precisely, upon striking the nuclei of atoms within the target. By measuring the directions taken by the scattered ions, and their momentums, the physicist can tell much about the structure and behavior of the target nuclei.

Accurate results from an experiment depend on the precision of the energy of the ion beam, its geometric localization, and accurate knowledge of the target's composition.

The scattered particles strike detectors in the target area, which feed a Niagara of signals into banks of electronic equipment in the accelerator control room. The signals indicate both the number of hits and the nature of the reactions.



Rings and bars protect central terminal of Van de Graaff from electrostatic breakdown.



Radiation detectors are made by drifting lithium ions through silicon and germanium crystals in drifting ovens. Detectors measure charged particles and gamma radiation.

Control by Computer. To enable physicists to make real-time decisions during experiments, the staff of the Nuclear Structure Laboratory and the Research Division of IBM are collaborating in the development of an advanced, computer-based data acquisition and control system. Headed by Dr. Martin W. Sachs of Yale and Dr. Joel Birnbaum of IBM, the project is designed to make the computer accessible to the experimenter in a flexible and natural way, so that it can serve as an extension of his analytic abilities and scientific judgment.

The project is keyed to the philosophy that the physicist need not be a computer expert. With an hour's training, he should be able, in the words of one project worker, to "plug his experiment into the system."

From the mass of signals entered into it, the computer analyzes only those that the experimenter has defined, through his program, as being of interest. As a filter, the computer readily fits into the lightning-fast world of the accelerator.

The system's real-time operation is a distinct advantage over other methods of weigh-

ing an experiment, in which several days might be required to find out whether the experiment had proceeded correctly. The high-speed cathode-ray-tube display enables the physicist to view plots of his experiment while it is in progress. If he finds it going astray, he can change its course accordingly.

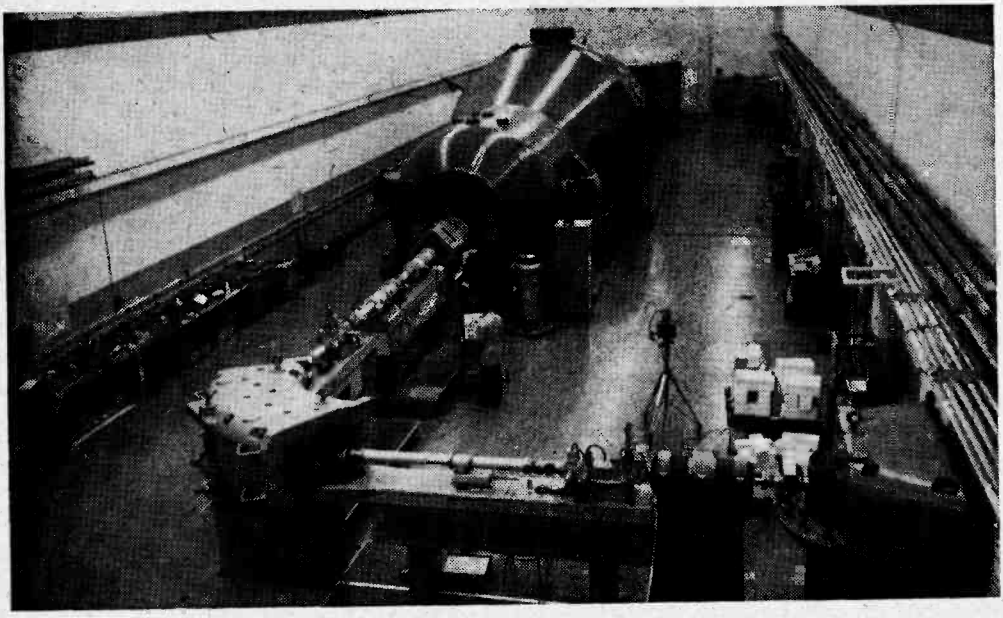
A multiprogramming system developed for the project provides for program preparation and data analysis as well as on-line data acquisition. As one feature of the system, a physicist can connect any FORTRAN or Assembler-language program to any of the buttons on the function keyboard by a control card. When a button is pressed, the system responds by locating and executing the associated program.

Moreover, the acquisition, display, and control of experimental data are readily changeable through the function keyboard or the graphic terminal and typewriter. All data-acquisition statements are programmed as two-part instructions. An action statement performs a particular function, such as pulse-height analysis, and a specification statement determines the operation's parameters, such as the number of channels in the pulse-height analysis.

Checking the Experiment. "Computer data reduction," explains Dr. Sachs, "enables a physicist to determine whether an unusual reading is a true result of the experiment or a flaw in the equipment. Without the computer, it might take weeks to find out." The ability to alter the course of an experiment while it us under way may save repeating the experiment—an expensive proposition when working with an accelerator.

Possibly the most striking achievement of the system, however, is that it can, under certain circumstances, enable the physicist to use his measurements to make an immediate test of physical theory, again while the experiment is in progress. In most cases, a test of theory can be made only after several stages of data reduction and analysis—hence the importance to the physicist of real-time processing.

The Control Interface. The heart of the system is a control interface that links the computer directly to the digital output instruments that carry information from the experiment. On one side of the control unit are scaler-timers, which keep track of experimental-data monitor registers, and analog-to-digital converters. This equipment was developed as part of the Yale project by IBM's Systems Development Division in Kingston, New York. On the other side of the control unit is a diode pinboard, half the size of a chess board, that determines which instruments will read data into the



Emperor accelerator is housed in 200 x 40 ft. vault in Yale's Nuclear Structure Laboratory. Ion source is at far end of accelerator tank; magnets (foreground) focus and direct ion beam.

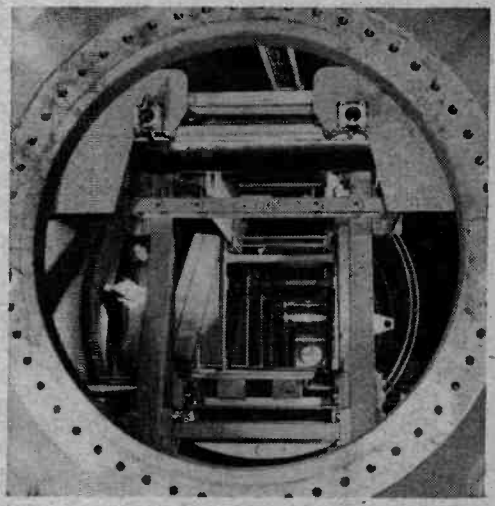
EMPEROR'S COMPUTER

computer and permits the instruments to be multiplexed among the experiments—all completely under electronic control.

When a physicist sets up his experiment, he prepares a pinboard by inserting tiny diodes into holes in the board. The diodes, in effect, order the information that will flow into the computer.

The Yale group is now engaged in a broad study of nuclear behavior. As Dr. Birnbaum puts it, "Nuclear physicists are searching for a unified mathematical model for all nuclear behavior—a mathematical statement of the conditions under which any nuclear reaction takes place."

In this search, the introduction of on-line computer facilities is providing more data than ever before—but far more important is an increase in the *quality* of data. The Emperor's computer provides a basis for solving physical problems that cannot be handled in other ways, and it is helping to make the physicist's choice of experimental alternatives both simpler and more meaningful. ■



View of accelerating structure inside pressure vessel during installation. Large cylinder at top is 100-hp motor driving belt which transports charge to high-voltage terminal. Glass and stainless-steel beams supporting high-voltage structure are clearly visible in foreground.

Overall view of Laboratory, looking north toward East Rock. Heavy Ion and Electron Linear Accelerator Laboratories appear at left; three entry doorways lead to storage space, offices and laboratories, and accelerator vault, respectively. Truncated pyramids on roof contain cooling towers for closed loop water supply in Lab.

ADD A FLASHING LIGHT TO YOUR TELEPHONE BELL

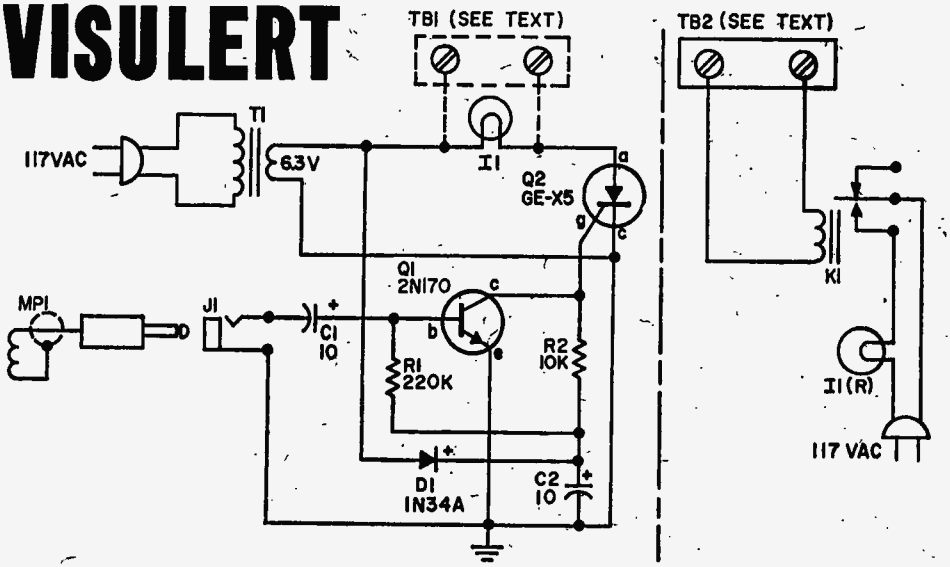
by Robert S. Kelland

ARE there times when you'd like to turn down the telephone bell so that baby or grandma can nap, and yet you need to know when that important call comes in? Because high platform noise overrides the normal telephone bell, and you're skeptical of the effectiveness of so-called loud ringers, do you have need for another means of alerting the shipping clerk to take a telephone call? Or, perhaps you know a deaf person who can't hear the phone bell at all.

Our Visulert, a small, self-contained, easily constructed telephone accessory, solves all these problems. And the beauty of it is that you don't have to connect it directly to the telephone lines, a no-no rule of most telephone companies.

An inductive pickup coil ordinarily used for recording phone messages, placed on or under a telephone, picks up just the ringing pulses by magnetic induction and feeds them to an am-

VISULERT



PARTS LIST FOR VISULERT

C1, C2—10-uF, 35-VDC miniature electrolytic capacitor (Radio Shack 272-1025 or equiv.)
D1—75-PIV, 50-mA silicon diode, type 1N34A
I1—Panel-mounting pilot lamp assembly with clear plastic dome lens (Lafayette 99E63406 for miniature bayonet base lamp 32E66194 or equiv.) (note: our model was adorned with the addition of a large plastic lens salvaged from a toy fire engine)
J1—Miniature phone jack (Lafayette 99E63141 or equiv.—includes matching plug)
MP1—Inductive pickup coil assembly (Radio Shack 44-533 or equiv.)
Q1—GE 2N170 npn germanium transistor
Q2—GE X5 silicon-controlled rectifier
R1—220,000-ohm, ½-watt resistor
R2—10,000-ohm, ½-watt resistor
T1—Filament transformer; primary 117 V, 50-60 Hz; secondary 6.3 V at 1.2 A (Radio Shack 273-050 or equiv.)
1—4 x 2¼ x 2¼-in. aluminum minibox (Lafayette 12E83704 or equiv.)
1—AC power cord (Lafayette 12E39011 or equiv.)
1—2 point + ground lug tie strip (Lafayette 32E12073 or equiv.)
1—5 point + ground lug tie strip (Lafayette 32E12131 or equiv.)
Misc.—Hookup wire, solder, hardware, spray paint or pressure-sensitive vinyl sheet (Contac or equiv.), grommets, etc.
If remote lamp is used add following:
I1(R)—50 to 250W, 117V lamp bulb in porcelain Edison base lamp socket, 3¼-in. diameter base (Lafayette 13E1359 or equiv.—mount on outer surface of junction box or cover panel of suitable box used)
K1—Spdt miniature ruggedized remote control relay (Lafayette 99E60915 or equiv.—mount on inner surface of box cover panel)
1—Pane for box (Lafayette 19E37010 or equiv.)
1—6¼ x 5¼ x 2¼-in. Bakelite Box (Lafayette 19E20016 or equiv.)
2—2-contact screw terminal strip (Lafayette 32E644488 or equiv.) (TB1, TB2)

plifier in the Visulert. This amplifier triggers an SCR that switches a lamp *on* and *off* in step with the pulsing of the ringing signal.

How It Works. Provided magnetic pickup MP1 is properly located within the ringer's magnetic field an electrical voltage is induced in the coil of MP1 whenever the ringer of a telephone is energized. This voltage is fed via jack J1 to the base of transistor Q1. The resulting amplified signal output on the collector of Q1 is coupled to the gate of silicon controlled rectifier Q2 and triggers it *on* whenever the signal appears on its gate. Lamp I1 is turned *on* each time Q2 is triggered *on* and remains *on* until Q2 is triggered *off* by a drop in the induced signal level. Since the ringer voltage is pulsating, the Visulert will flash its lamp *on* and *off*, following the ringer pulses.

Building Visulert. Our model is housed in a standard 4 x 2¼ x 2¼-in. aluminum minibox. Though the layout isn't critical, you will speed up your construction time by following our layout as shown in our photos.

All of the components are mounted either directly on the minibox or to tie strips, which

(Continued on page 100)

how Charlie flipped... and won

by Art Fettig

CHARLIE Spaulding's mind was bugged. His dreams suffered from excessive roll over. He looked at the world and saw snow, venetian blinds, ghosts; and the world rolled and rolled over again. Mouth-watering steaks had begun to look like TV tubes to Charlie. Twice in the past two days he had caught himself trying to use the cigar lighter as a knob to adjust the picture on the windshield of his automobile. Friendly, lovable Charlie Spaulding had repaired so many TV sets in the past two weeks that it was changing his entire personality. Charlie's hang-ups were hung-up.

He'd been carefree and happy all summer when the usual lull overtook the TV repair business. He'd made a point of resting up sufficiently so that he'd be ready for the boom when it struck in the fall. Few customers bothered with their TV problems during the warm summer months. They were content to swim and boat and sweat it out at the friendly drive-ins and most of them couldn't care less if their screens looked like Modern Art.

Then it exploded like it always did when the new shows had their premieres. Charlie's list of calls for repair work looked like a Chinese laundry slip. To compound the problem, Frank Fenner, Charlie's number-one repairman, picked that time to go on a three-week honeymoon. Big-hearted Charlie told them to have a good time and resigned himself to his fate. He rolled up his sleeves and started in.

Charlie knew his trade. He could smell out a faulty tube from five feet away. He was honest, too. Charlie believed that he could make the most money by doing fast repair work and charging honestly for it. None of this have-to-take-it-to-the-shop talk for Charlie. He made most repairs in the customers' homes. Charlie gave his customers their money's worth and that is why so many people called Charlie with their problems. "Why did they all have to pick the same week to call?" Charlie asked himself, but remembering the saying about people who answered themselves he gave no reply.

Charlie had survived two seven-day weeks. He'd put in mostly 14-hour days and maybe that was why it happened. Anyway, Charlie's mind just hopped off the track. He was just starting work on one of those big Admavox wall combinations. You know, the three thousand dollar job with the color TV, stereo recorder, multi-band radio, and you name it?

Charlie was standing there in the Harris' den with the set pulled away from the wall when suddenly he felt an overpowering impulse to give in to that maddening impulse to become an electronic experimenter. Why did he always have to put in the right tube? Why did he have to submit to those printed circuit boards. Why, just once couldn't he reach into his parts bag and go just *whee*!?

how Charlie flipped

Conformity was just great for a while but after two weeks of 14-hour days Charlie needed a small rebellion and this was it.

And what a beautiful outfit to set out with. Charlie got the most fiendish look in his eye and he set to work with a passion. His sensitive hands flew wildly at the electronic components. It was not simply a wild spree. It was as if all of the creative energy that had existed in Charlie before had suddenly sprung forth. After a full two hours of intense work Charlie pushed the set back against the wall, wrote out his usually modest bill, and laid it on the set. Wearing the widest smile he had worn in months, he left without waiting for Mrs. Harris to make her usual inspection.

When wild-eyed Sam Harris returned from a maddening day at the TV studio, he was exhausted. All life had become a catastrophe. Actor problems. Union problems. Electrical worker problems. The writers wouldn't write. Even the cigarette machine wouldn't work. It was one of those days that would make a grown man cry, but Sam Harris didn't cry. He held it all inside him and brought it home with him. Every night he brought it home to his den. Specifically, to his Admavox wall combination.

Silently Sam rushed passed his wife as he headed for the den. "Your TV is fixed, dear," she called as he passed. Sam offered a grunt for a reply.

Sam locked the door and began his nightly unwinding ritual. It was crazy, certainly, but Sam was a TV producer and they deserve a little understanding. He poured himself five fingers of Scotch and then with a childish grin on his face he snapped on the television and turned up the volume. Next he switched on the stereo player and cranked up the volume on it. In a final glorious gesture he snapped on the radio and turned up the volume full blast.

Now he went to his luxurious leather couch and lay prone, sipping the Scotch and unlaxing. He listened for the usual roar of the three instruments, but instead of the deafening roar an eerie sound of floating waves came forth, softly at first, and then gradually building. Now the screen came alive with a fiery psychedelic glow and Sam Harris sat upright and stared right into the center of the bright eerie ball of light.

The troubled, worried look that had been on Sam's face began to leave, and after but a moment he wore a look of angelic serenity. He smiled now. A broad, excited smile. The kind he wore years before, when producing was not such a burden. He sprang lightly from the couch and danced, yes glided across the room and snapped the set *off*.

Sam Harris grabbed the telephone and rapidly dialed Charlie Spaulding. Charlie had just walked through the door and exhaustion was about to claim him. "Yes, Mr. Harris?" he answered patiently.

"Charlie," Harris roared, "get over here right away. And bring your lawyer."

Charlie's spirits dropped that final foot to total despair. "So sue me," he said. "I'm sorry about what I did but I had to do it."

"Sorry?" Harris asked. "You should be sorry. You've just come up with the greatest invention since the wheel and you're sorry?"

"Invention?" Charlie asked.

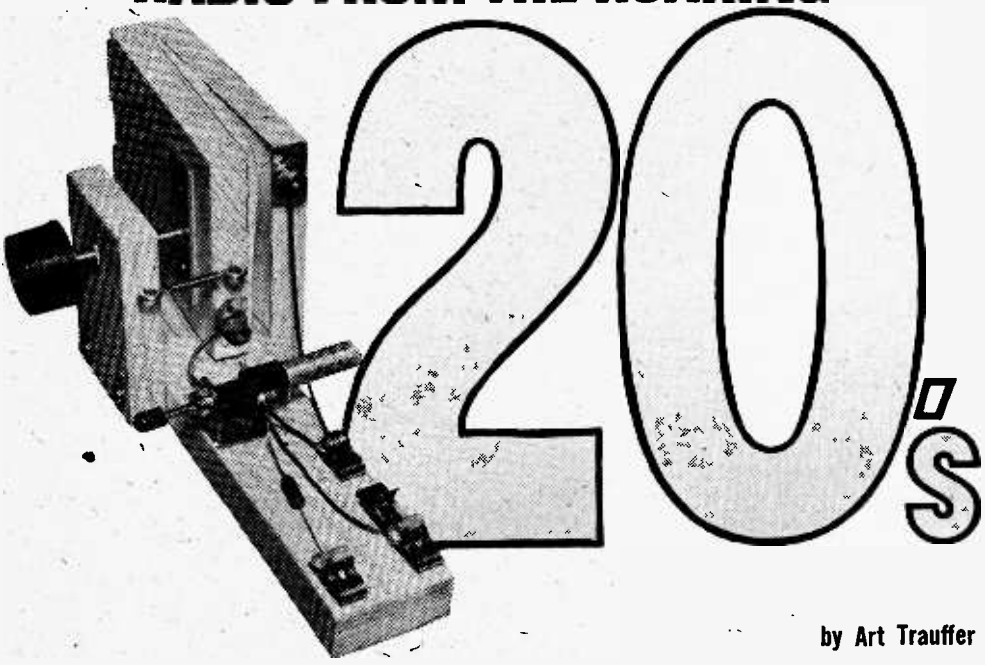
"Yes, invention." Harris said. "You've made a Garden of Eden from the Vast Wasteland. That's why you should bring your lawyer. I want to sign a contract with you, Charlie. We'll make millions. I predict we'll put the TV industry right out of business. We'll wipe out mental illness. Charlie, it's just beautiful. All life is beautiful after looking at your invention."

"I'll be right over," Charlie said.

"Then you'll sign a contract with me?" Harris asked.

"Later for the contract." Charlie said. "I'm coming over to marvel at what I have wrought. ■

RADIO FROM THE ROARING 20's



by Art Trauffer

Build an authentic Book Condenser Crystal Set

HERE'S a radio construction project that's just the reverse of what you'd expect. In this one, instead of making the coil and buying the variable tuning capacitor, we'll show you how to make a variable capacitor for use with a commercially made coil. You've got to admit that this is a project with a twist!

The variable capacitor we're going to show you how to build is called a book condenser. Its plates are hinged like the pages in a book, and capacitance is varied by increasing or decreasing pressure on the supports of the plates, which, in turn, increase or decrease spacing between the insulated plates—thus varying the capacity. Though this is a unique approach to varying capacity of a tuning capacitor, unfortunately we can't claim to be its innovator. Way back in the early 1920s, Crosley Radio Corporation (now a division of AVCO Corp. and renamed AVCO Electronics Div.) patented a design for and manufactured book condensers. These were used in the then famous Crosley Model 50, better known as the *Crosley Pup*, a one-tube broadcast band radio receiver.

Our *Book Condenser* is quite similar in basic design to the Crosley condenser. It's also easy to build, since it uses hardwood blocks, aluminum foil, tissue paper, etc., all materials normally found around the house.

The coil, a major component of the radio you'll wind up building upon completion of the condenser, is a standard ferrite cored variable loopstick used in many commercial radio sets, and therefore easily procured as a replacement part.

The How of It. Either the coil or the tuning capacitor shunted across it must be capable of having its parameters varied in order to tune across the band for which the combination has been designed. In this project the capacitance of the tuning condenser is varied by moving the plates closer together without shorting them, for maximum and moving them further apart for minimum capacitance. As the plates are brought closer together capacitance increases; as they are separated it decreases. That's all there is to it. The mechanical construction we've adopted is quite simple and therefore it's easy to make our variable book capacitor.

Making the Book Condenser. Two plates, one fixed in position and the other hinged so that it can be moved closer or farther

away from the fixed one, is how we achieve variation in capacity. The plates for the condenser are made by carefully cementing aluminum foil to one side of each of two wooden blocks. The two blocks are mounted so that the foil sides face one another. A piece of unused airmail stationery, placed between the foil, insulates them.

The thickness of the paper determines maximum capacity—the thinner the paper the higher the capacity. That's why we've specified airmail stationery. This is just about the correct thickness for the plate sizes used to give our *Book Condenser* the capacity required to tune the loopstick coil over the broadcast band. The sizes of the blocks and mechanical details are shown in our photo and in the materials list.

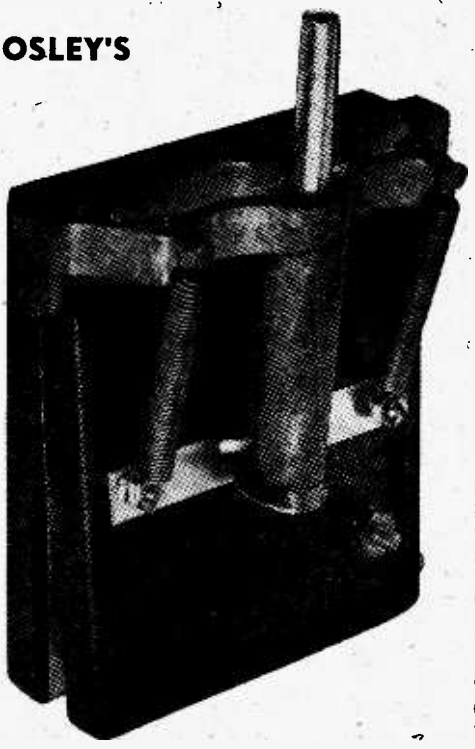
Plate Connections. Be sure to leave a tab of aluminum that can be folded over the edge of the wooden block to make connections to the plates. After the cement has dried, fasten a soldering lug to the tab with a wood screw, making certain that the eyelet of the solder lug is held tightly against the foil by the head of the screw.

The foil must be as flat as possible, so be sure all air bubbles are pressed out before the cement dries and be careful not to tear the foil. A good cement to use is Pliobond. Since wood is more porous than the metal foil, spread the cement on the foil first and then on the wood. Press the foil to the wood immediately after spreading the cement on the wood.

A good way to ensure that the foil will be cemented smoothly is to first place the foil on a table top or other hard, smooth surface, facing *up* the side on which the cement has been spread, and then pressing down the cemented side of the wood block to the cemented side of the foil. After the cement has dried, trim excess foil to the size of the wood blocks. Cement the paper insulator, which has been cut slightly larger than the foil, to the hinged end of the large wooden block that is fixed in position.

When mounting the hinges hold the two wooden blocks together in a vise, or clamp, to ensure correct movement of the small wooden block.

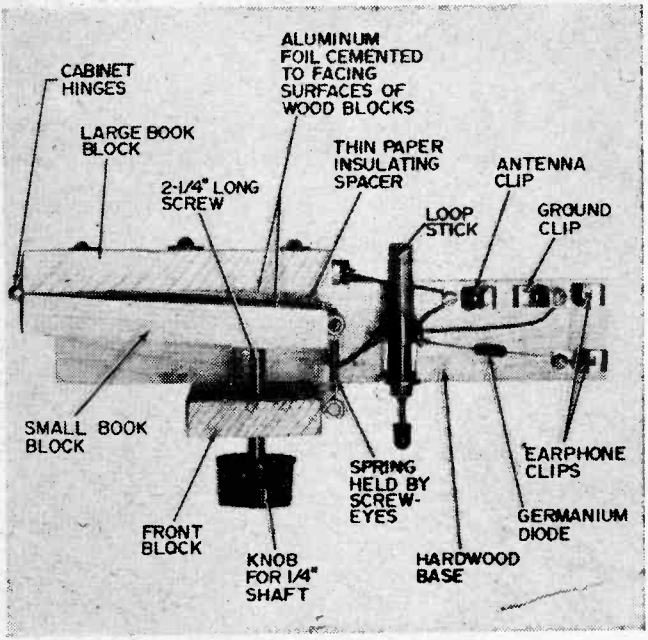
IN THE BEGINNING WAS CROSLEY'S BOOK CONDENSER



The Crosley book-type variable condenser consists of two molded insulating plates coated with metallic foil and hinged together at one edge so that they can be swung toward or away from each other like the leaves of a book. A cam, mounted on a shaft passing through a bearing in the condenser frame, and provided with a knob and dial, offers the mechanical means of adjusting this condenser. A thin sheet of mica is mounted between the plates in order that the capacity may be sufficiently high without making the plates excessively large, and so there will be no danger of short-circuiting no matter how close together the plates are pressed.

—Crosley Radio Corp., 1923

In this case innovation is the mother of invention. On the previous page we showed how one manufacturer, Crosley, made their commercial Book Condenser from metal and molded insulation. We've duplicated it with wood and aluminum foil. This top view of a complete radio shows its construction as well as location of all major components.



A screw or threaded rod, approximately 2¼ in. long and having fairly heavy threads, is threaded through the Front Block to exert pressure on the metal strip fastened to the small wooden block. Turning the knob clockwise causes the screw to change the length of the screw that projects beyond this Front Block. This in turn moves the Small Book Block closer to the Large Book Block.

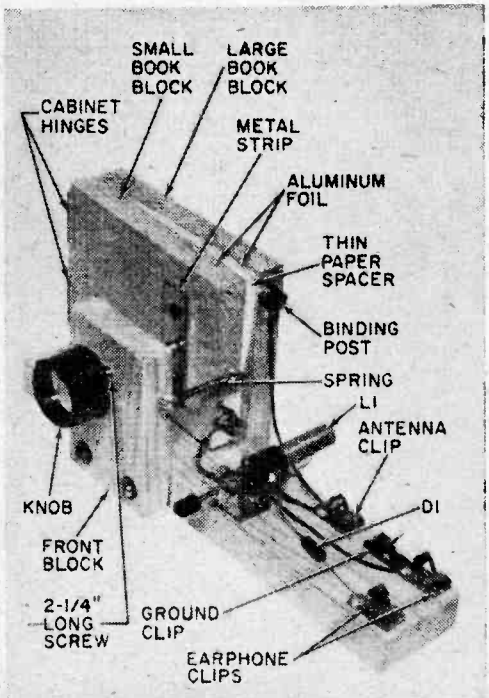
When the screw is turned counterclockwise, the part of the screw that moves the Small Book Block is shortened. The Small Book Block is pulled away from the Large Book Block by the spring stretched between the Front Block and the Small Book Block. Small screw eyes, one in the free end of the Small Book Block and one in the end of the Front Block that is adjacent to the free end of the Small Book Block, hold this spring in position.

Now the Coil. Remove all but 80 turns of wire from the loopstick coil to adjust its inductance to permit tuning the broadcast band with the capacitance of our Book Condenser. Mount this coil assembly on a 1 x 1 x ½-in. metal bracket with the ferrite core adjusting screw facing the front of the radio and fasten a small knob on the adjusting screw. You may find slight changes in the position of the core will improve the performance of the receiver.

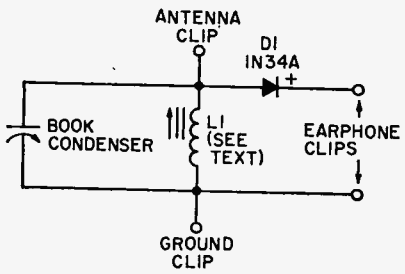
Connect the Book Condenser, coil, and crystal diode as shown in the schematic.

Enjoying Book Condenser Radio. Since there are no amplifier stages in this radio,

Just in case top view may not reveal all intimate details of construction of our Book Condenser we've included this oblique view. It's really a very crude approach by comparison with commercially produced ones even though they were made way back when radio was in its infancy.



RADIO FROM THE ROARING 20's



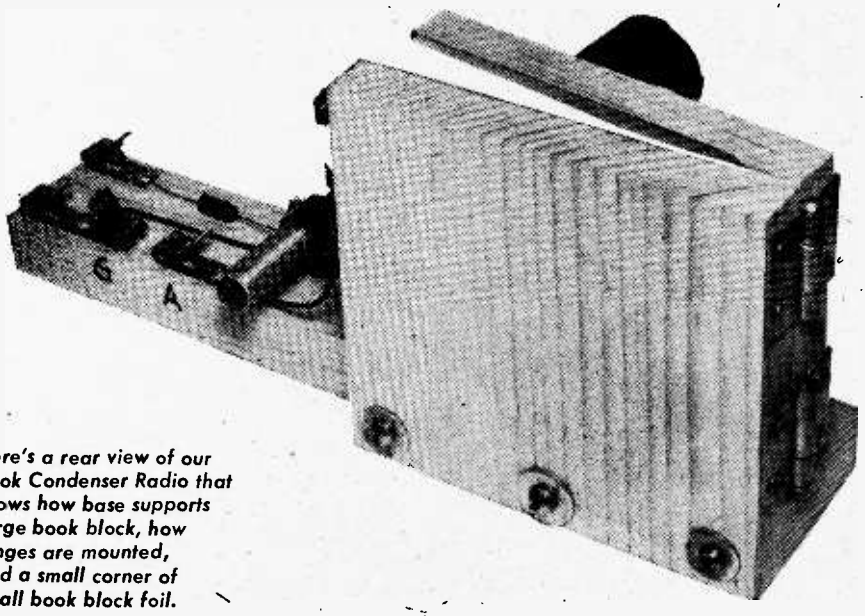
Back in the beginning we had solid-state radios but then they were called crystal sets. Note simplicity of circuitry.

BILL OF MATERIALS FOR BOOK CONDENSER RADIO

D1—Germanium diode, type IN34AS, IN60, IN82A, or IN295
L1—Variable loopstick (Lafayette 32E41064 or equiv.)
4—Fahnestock clips, medium size (Lafayette 32E71028 or equiv.)
1—Base, hardwood, 8½ x 1½ x ¾ in.
1—Block, hardwood, 3 x 2 x ½ in.
1—Small book block, plywood or hardwood, 4 x 3 x ½ in.
1—Large book block, plywood or hardwood, 4 x 3¾ x ½ in.
2—Brass cabinet hinges, 1 x 1 in. (usually available with required brass flathead screws)
1—Long screw, ¼-28NF x 2¼ or equiv.
1—Brass or polished steel metal strip, 2 x ½ in.
1—Spring, 1 in. long x 3/16 in. diameter
1—Knob for ¼-in. shaft
2—Screw eyes, ½-in.
Misc.—Aluminum foil, paper spacer, ½-in. round head brass wood screws, 1¼-in. round head brass wood screws, washers, wire, glue, solder etc.

it's important to use a long antenna and good water-pipe ground in order to collect as much signal as possible for the set. Since the output is high impedance, you must use either high-impedance magnetic or crystal headphones on the output.

Because the Book Condenser Radio has a simple single tuned circuit, it will not tune sharply, and therefore will receive only those stations whose signal strength is high and that are widely separated from other nearby stations. Strong local signals will be received best. If you are located near several powerful stations, this simple, broad-tuning receiver will make an ideal AM tuner for your hi-fi system. ■



Here's a rear view of our Book Condenser Radio that shows how base supports large book block, how hinges are mounted, and a small corner of small book block foil.

they cook with COLD HEAT!

by Jorma Hyypia

It all started with a gooey candy bar. One day twenty some odd years ago, Dr. Percy Spencer was puttering with a radar set at Raytheon's New England laboratories. Reaching into the pocket of his white lab coat for a candy bar, he found only a warm, soggy mess. That was when Dr. Spencer discovered that microwaves generated by a radar power tube can cook food.

Since then, microwave cooking has come a long way. On an industrial scale it is used to fast-cook many kinds of food products—for example, 20,000 or more pounds of chicken parts per day. Have you noticed that those crunchy

COLD HEAT

potato chips no longer have a dark, half-burned look? It's because microwaves remove just the right amounts of residual water without scorching the outer surfaces of the chips.

Microwave ovens are also used extensively wherever large quantities of food must be prepared speedily, as in restaurants, hotels, medical and other institutions. Now microwave ovens are on the verge of revolutionizing home cooking. Tens of thousands of small microwave ovens are already used in private homes. But this is only a beginning—especially if the prices of the ovens can be cut substantially from the $500.00 and more that they cost now.

Cold Heat. Microwaves constitute that range of electromagnetic energy that lies between radio waves and infrared radiation. Though the exact limits of the microwave spectrum are a bit vague, they are generally put at about 1000 MHz on the low end, and at 300,000 MHz at the top.

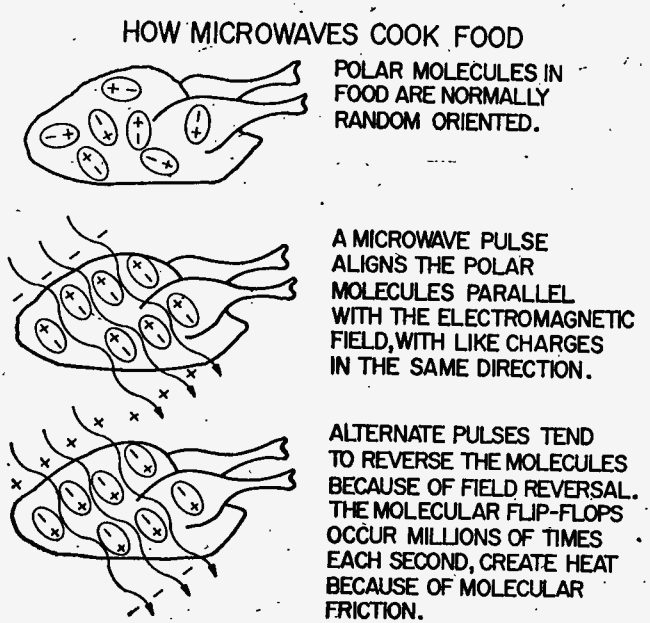
Under the right conditions, these high-frequency energy radiations can produce considerable amounts of heat, though not in any conventional way. In the cooking of food, for example, the heat is produced within the food by induced agitation of the molecules that make up the food.

As our diagrams show, the molecules in any substance—chicken meat, for example—are ordinarily randomly oriented with respect to one another. When a microwave pulse passes through the chicken, it tends to align the polar food molecules parallel to the direction of wave propagation; all positive ends then point in one direction, all negative ends in the other. Within a fraction of a millionth of a second, the pulse reverses and the food molecules also try to reverse themselves accordingly. This flip-flopping occurs thousands of millions of times every second and results in considerable molecular friction. As anyone knows, friction produces heat. And heat cooks.

You might think of this as a kind of cold heat. The meat or other food becomes hot, of course, but the oven and the dishes holding the food remain cool to the touch. This is because the heat isn't generated by some external element, such as an electrical coil or gas flame, and then transmitted to the food through the air in the oven. Only cool microwave energy is transmitted through the oven, and the heat is produced only when it starts bouncing the food molecules about.

This still doesn't explain why the metal walls of the oven remain cool. The answer is that metals reflect rather than absorb microwaves. This is why metal cookware cannot be used in microwave ovens; the food must be contained in plastic, glass, or paper containers.

Unlike any other means of cooking food, microwaves generate no heat as such. Theory is that they cause food's polar molecules first to align with electromagnetic field, then alternately reverse because of field reversal. Resulting molecular friction causes heat, which quickly cooks food.


HOW MICROWAVES COOK FOOD
POLAR MOLECULES IN FOOD ARE NORMALLY RANDOM ORIENTED.
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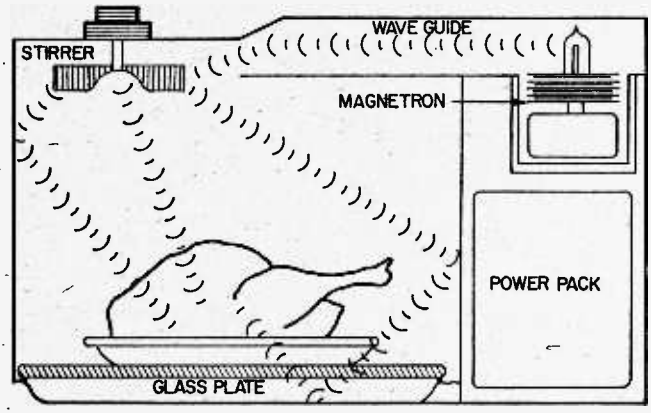


Artist's conception of interior of microwave oven, using magnetron as its source of microwaves. Stirrer at upper left is nothing more than bladed fan, positioned so it can direct microwaves throughout entire interior of oven.

Oven Construction. There are four basic parts to a microwave oven: the microwave generator and its associated power pack; a wave guide that carries the microwaves to the oven; the oven itself which serves as a resonant cavity; and a stirrer.

In most ovens now on the market, the microwaves are generated by a *magnetron*, though klystrons and amplitrons can also be used. Some experts foresee eventual replacement of magnetrons by power grid tubes which operate at lower voltages provided by simpler power packs.

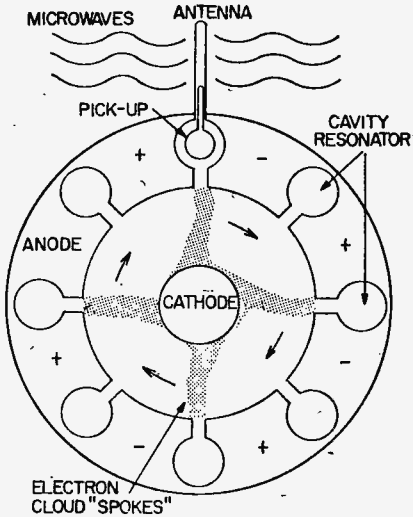
The magnetron converts DC energy, obtained from a power supply, to high-frequency energy of about 2450 MHz. This microwave energy is conducted to the oven by means of a hollow tube called a *wave guide*. The oven is a multi-mode resonant *cavity* designed so that the microwaves will bounce from wall to wall, passing through the food in their travels.

To resonate properly, the shape and size of the oven must be designed with considerable care. One of the trickiest problems was to create a uniform energy density within the oven cavity so that the food would cook evenly. In an ordinary oven the heat tends to distribute itself evenly regardless of the oven shape. Not so microwaves, even if the oven cavity is dimensioned to provide the largest number of resonant modes possible within the frequency limits imposed by the magnetron.

The ingenious solution was to add a microwave *stirrer*. This is nothing more than a bladed fan operated by a motor. It is positioned so that microwaves emerging from the wave guide strike the blades. As the blades rotate, they reflect the microwaves in different directions in the oven. The stirrer also constantly alters the effective dimensions of the oven cavity, as is demonstrable by measuring microwave frequency changes in the oven when the stirrer is operating.

Magnetrons Favored. Magnetrons are currently the most popular microwave generators for heating applications, largely because they cost less than other devices and have high energy conversion characteristics—80% as compared to 65-70% for amplitrons and 50% for klystrons. The magnetron's main drawback has been its relatively short life; but recent improvements have extended the magnetron's useful life to over 10 years in home cooking applications.

Considering the energy wallop delivered by a magnetron, it is a remarkably simple



Simplified sketch of magnetron reveals how device produces microwaves. Electron "spokes" revolve around its cathode, generate microwaves in resonant cavities of anode.

COLD HEAT

though ingenious device. Heart of the magnetron is a small cylinder having a cathode rod in the central opening, and a series of resonant cavities in the outer anode body of the cylinder (see our diagram).

When pulsating DC current is applied to the cathode, it emits electrons just like any ordinary electron tube. But here the resemblance ends. Instead of traveling directly to the anode, the electrons tend to bunch, and these clusters spin rapidly around the central cathode hub like the spokes of a wheel.

As each electron "spoke" passes the mouth of a resonant cavity in the anode, it induces a surge of current around the anode walls, thereby transferring energy to the resonant cavity.

One cavity has a wire loop that serves as a pickup for the high-frequency pulses thus generated. The pulses are carried to an antenna atop the magnetron, from which they are beamed into the wave guide, and along it to the oven cavity.

Home-type microwave ovens operate off regular 117-V lines (grounded, and fused for 20 A), draw 13 to 18 A, and generate over 5000 VDC to operate the magnetron. A typical magnetron draws a current of about 250 mA.

Cooking With Microwaves. Microwave ovens are not intended to replace standard ovens, only supplement them. Many food items can be cooked faster and better with microwaves than with conventional ovens—but not everything.

When it works, it's fast! For example, it takes a couple of hours to properly barbecue a chicken by conventional means, only 45 minutes with microwaves. Want a quick hamburger? It will be ready in 60 seconds instead of the usual 12 minutes. You can start dribbling a poached egg onto your tie in one minute, instead of the usual five. Right down the line—meats, vegetables, cereals, soups, beverages— just about anything you eat or drink can be prepared with considerable savings in time.

Many foods also gain in nutritional value. MIT scientists have discovered that microwave-cooked foods retain from 4% to 17% more of such vital nutriments as vitamin C, riboflavin, and thiamin.

One thing may bother you. Microwaves do not produce a browned pie crust, or a properly seared surface on meat. Such foods don't look "done," though they are fully cooked. The solution: stick them into your regular oven for a quick browning. Prolonged cooking in the microwave oven will not work; all you will get is a dried-out cake or chop.

Microwaves are best for thawing (frozen foods), quick warming, reheating (leftovers), and for preparing simple foods. Oven makers urge that you use conventional cooking methods for expensive roasts of beef, pork, hams, and lamb. They deserve that extra loving care that only a conventional oven can provide. But when it comes to reheating these for the next meal, you can't beat microwave.

Metal utensils can't be used in microwave ovens because they create high-standing-wave reflections that may arc and damage the magnetron. Moreover, they prevent the microwaves from entering the food from all sides.

Glass, plastic, ceramic, and paper containers all are satisfactory. But remember to remove foods from aluminum-foil containers they may be packaged in. Many foods can be portioned onto serving plates and carried directly to the table after cook-

Utilizing space-age technology, this Tappan electronic oven generates no external heat, yet cooks hamburger in 1 minute, fries strip of bacon in 2½, bakes potato in 4.

Single-oven Versatronic range by General Electric cooks food electronically in minutes, or conventionally, or both ways at once. Only 30 in. wide, Model JE 856E (shown here with JV 31 hood) features infinite controls on surface units and self-cleaning microwave oven.

ing because the plates don't become hot.

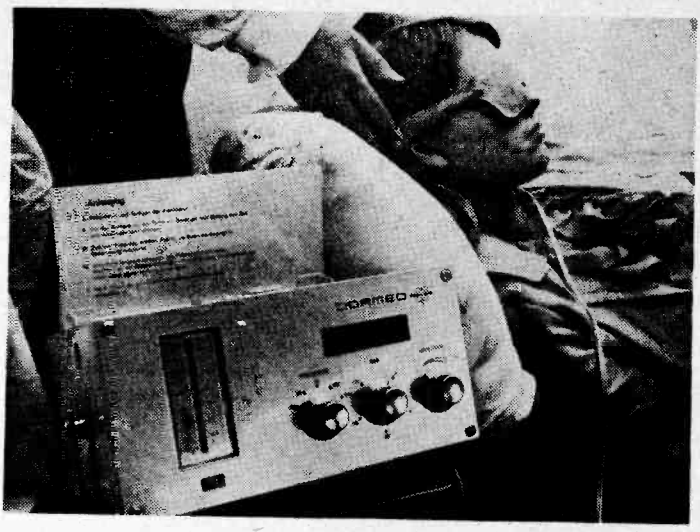
And here's a real plus. Since the oven walls don't become hot, splashed-on foods don't bake into the usual tough scales. To clean a microwave oven you need only wipe with a damp cloth.

Safety. It should be obvious that if microwaves can cook chicken, they can also cook a two-legged chick. These ovens must be used exactly as manufacturers direct. Government agencies are now watch-dogging microwave ovens to make sure they are safe, though there have been no reports of injuries despite their wide institutional usage.

Doors of microwave ovens have double interlocks which turn off all cooking power when opened. Nonetheless, to play it safe, stay at least an arm's length away from the oven when it's in operation. And don't let children watch the cooking process.

In a few years, microwave ovens may be as commonplace as rotisseries have become in the past few years. They are a housewife's dream. And if you live alone and cook your own meals, a microwave oven could change your whole way of life. Just think. You slide a TV dinner into the oven, and minutes later it's ready to eat. Afterwards you just throw away the paper plate; no pots, pans, or dishes to wash. Why, it could give you a whole extra hour with your CB rig every night! ■

Perhaps this century's most significant cooking advancement, microwave oven promises to save housewife countless hours in her kitchen. Eye-level oven on this GE Versatronic range cooks conventionally, boasts automatic rotisserie. Lower oven is microwave unit, which, like oven in stove above, is self-cleaning. This is GE's Model JE 896E.



With patient resting comfortably on back, operator adjusts spectacles containing sleep-inducing electrodes so they rest over eyes and just behind and below ears. Generator in foreground delivers pulsating current to patient's central nervous system.

Switched-on Flake-out

"Nothing to be afraid of," purrs operator, as she prepares to fit electrodes to patient's head. Four electrodes are covered with foam plastic and slightly moistened with salt solution to make better contact. Two go over eyelids, two just behind ears. Powered by six flashlight cells, generator produces square waves between 12 and 200 Hz.

FIRST impression the patient gets is a flickering sensation in the eyes—not unpleasant, and vaguely smoothing. This dies down after a few minutes, and a feeling of warmth, gentle and restful, seems to flood the whole system. Muscles relax, tension disappears. The time necessary to bring sleep varies from patient to patient, but strength, frequency, and rate of the dosage are all under the control of the physician or operator giving the treatment.

Where are we? In London, no less, where over 3,000,000 sleeping pills pass through British throats nightly—or at least they used to. Now, a new German invention called "Dormed" promises to put an end to pills of the sleep-inducing variety, perhaps forever. Basically, it consists of a set of electrodes in the form of a pair of spectacles. Fitted on a patient's head, they cause a pair of electrodes to rest lightly on the eyelids, another to rest just behind the ears. Pump in a signal from a small pulse generator resting on the bedside table, and—you guessed it—pill-less, pillow-talkless sleep.

Ah, sandman! It *is* you? ■

a DXer's OPEN SESAME to Old Mexico

by Don Jensen

YOU'RE tooling along Route 39 in your fastback. The weather's clear, the track fast. There's a blonde in the bucket seat beside you, and an overripe melon of a moon hangs just above the horizon.

You turn the radio dial, looking for some groovy music to set the mood. Music—a gaggle of guitars, trumpets chording in thirds, a madly-malleted marimba—blares from the speaker. It's Mighty 1040, Wonderful WAMMO Radio, right?

Wrong, you discover a few moments later when the announcer cuts in with a quick burst of Spanish. Forgetting the chick at your elbow, you concentrate on the lingo. Nope, it's not your favorite rock-jock, old buddy. You've just DXed your first Mexican station!

Many DXers get started this way, accidentally tuning in Mexico on their standard broadcast-band radios. And, it's a good starting point for hobby newcomers. No special receiver is necessary. Distances, by shortwave standards, aren't great. There are plenty of easy-to-log stations, some of them more powerful than anything in the U.S.

Callous-eared veterans, too, will find all the challenge they could want in tuning mini-watt Mexicans on the crowded graveyard frequencies. To be sure, virtually all programming is in Spanish, but don't let that scare you off. You don't have to be a linguist to score. Careful listening and some experience is all you need to pick out the station identifications. *(Turn page)*

a DXer's OPEN SESAME to Old Mexico

MEXICAN STATES

Ags.—Aguascalientes	**Gto.**—Guanajuato	**Qro.**—Queretaro
***B.C.**—Baja California	**Hgo.**—Hidalgo	**Sin.**—Sinaloa
Cam.—Campeche	**Jal.**—Jalisco	**S.L.P.**—San Luis Potosi
Chih.—Chihuahua	**Mich.**—Michoacan	**Son.**—Sonora
Chis.—Chiapas	**Mor.**—Morelos	**Tab.**—Tabasco
Coah.—Coahuila	**Nay.**—Nayarit	**Tams.**—Tamaulipas
Col.—Colima	**N.L.**—Nuevo Leon	**Tax.**—Tlaxcala
****D.F.**—Distrito Federal	**Oax.**—Oaxaca	**Ver.**—Veracruz
Dgo.—Durango	**Pue.**—Puebla	**Yuc.**—Yucatan
Gro.—Guerrero	***Q.R.**—Quintana Roo	**Zac.**—Zacatecas

*Territory or territories **Federal District

On The XE Beat. Mexican stations have call letters beginning with XE, (a few FM and TV outlets use XH prefixes) followed by one, two, or three additional letters. Study the phonetic Spanish alphabet (see our box) and you'll soon be identifying, "EH-keess, eh, ah, beh, seh," as "XEABC."

As in other Latin American countries, some broadcasters in Mexico use identifying slogans, e.g., *Radio Acapulco, La Voz de la America Latina* (Voice of Latin America), etc. Some handy words to know are *cadena* (network), *emisora* (broadcasting station), *sistema* (system), and *ondas* (radio waves).

Probably the easiest medium-wave Mexican to hear, regardless of where you live, is the huckster's friend, XERF, 1570 kHz. Located near Ciudad Acuña, across the Rio Grande from Del Rio, Texas, this potent 250 kWer, for years, has been a boon to mailorder tombstone peddlers and Bible-thumping fundamentalist preachers, who use its facilities to reach rural America. More recently, fans of far-out California disc jockey Wolfman Jack have been able to hear his taped programs over XERF. Aimed at U.S. audiences, its programs are in English and hardly typical of Mexican radio.

Slightly more interesting to DXers is another 250-kW AM outlet, XEW, 900 kHz, in Mexico City. It may be one of the first Mexican stations you log and before long, you may consider it little more than a pest when its solid signal blocks out other, weaker DX stations.

Among the high-powered transmitters in our neighbor to the south are XEUN, 860 kHz; XEQ, 940 kHz; XEDP, 1060 kHz; XERCN, 1110 kHz; and XEB, 1220 kHz; all in Mexico City. Another in the capital city is XEX on 730 kHz, which has repeater outlets at Leon and Veracruz on the same frequency. XETRA, 690 kHz, at Tijuana, directs its programs at the Southern California audience. Another strong border station is XELO, Ciudad Juarez, on 800 kHz. And, at Monterrey, XEG on 1050 kHz, runs 100 kW. See our listing for several hundred more to-shoot for.

On The Short Side. Turning to shortwave, you'll find fewer Mexican stations, but plenty of challenge. Easy? Some of them are, but a scattered few on the very low frequencies are as difficult to log as any station in the world. A number of Mexican SWers merely relay medium-wave programming; others originate their own broadcasts. Ranchero music is typical fare, but the university-run stations, of which there are several, tend to offer more educational and talk shows in Spanish and a higher class of music, often symphonic.

Currently, the hottest Mexican on short-

PHONETIC SPANISH ALPHABET

a = ah	**g** = heh	**m** = EH-meh	**t** = teh
b = beh	**h** = AH-cheh	**n** = EH-neh	**u** = oo
c = seh	**i** = ee	**o** = oh	**v** = veh
d = deh	**j** = HOH-tah	**p** = peh	**w** = DOH-bleh veh
e = eh	**k** = kah	**q** = koo	**x** = EH-keess
f = EH-feh	**l** = EH-leh	**r** = EH-reh	**y** = ee-gree-EH-gah
	ll = EH-yah	**s** = EH-seh	**z** = SEH-tah

MEXICAN MEDIUM-WAVE BROADCAST STATIONS

kHz.	Call	Location
540	XEWA	Monterrey, N.L.
	XEWA	San Luis Potosi, S.L.P.
550	XEAF	Guadalajara, Jal.
	XEKL	Jalapa, Ver.
	XEQW	Merida, Yuc.
	XEUC	Tehuantepec, Oax.
560	XEOC	Mexico City, D.F.
570	XEVX	Comalcalco, Tab.
	XENZ	Culiacan, Sin.
	XEBJB	Monterrey, N.L.
	XELQ	Morelia, Mich.
	XEOA	Oaxaca, Oax.
	XETJ	Torreon, Coah.
580	XEFI	Chihuahua, Chih.
	XEHP	Ciudad Victoria, Tams.
	XEDZ	Cordoba, Ver.
	XEAV	Guadalajara, Jal.
	XEMU	Piedras Negras, Coah.
	XEUE	Tuxtla Gutierrez, Chis.
590	XEE	Durango, Dgo.
	XEPH	Mexico City, D.F.
	XEFD	Rio Bravo, Tams.
600	XEBB	Acapulco, Gro.
	XEZ	Merida, Yuc.
	XEDN	Torreon, Coah.
610	XECW	Ciudad Valles, S.L.P.
	XEEL	Fresnillo, Zac.
	XEGS	Guasave, Sin.
	XEJA	Jalapa, Ver.
610	XEBX	Sabinas, Coah.
	XEKZ	Tehuantepec, Oax.
	XEUF	Uruapan, Mich.
620	XEBU	Chihuahua, Chih.
	XECK	Durango, Dgo.
	XENK	Mexico City, D.F.
	XEOO	Tepic, Nay.
	XEACM	Villahermosa, Tab.
630	XEACA	Acapulco, Gro.
	XEFU	Cosmaloapan, Ver.
	XERPS	Mazatlan, Sin.
	XEFB	Monterrey, N.L.
	XETS	Tapachula) Chis.
650	XETNT	Los Mochis, Sin.
	XEZM	Zamora, Mich.
660	XERPM	Mexico City, D.F.
670	XETOR	Torreon, Coah.
680	XEFO	Chihuahua, Chih.
	XEORO	Guasave, Sin.
	XELG	Leon, Gto.
	XEKQ	Tapachula, Chis.
	XEFJ	Teziutlan, Pue.
690	XEN	Mexico City
	XETRA	Tijuana, B.C.
700	XEAR	Zapopan, Jal.
710	XEKU	Acapulco, Gro.
	XERL	Colima, Col.
	XEBL	Culiacan, Sin.
	XEMP	Mexico City, D.F.
710	XEON	Tuxtla Guitierrez, Chis.
730	XEX	Leon, Gto.
	XEX	Mexico City, D.F.
	XEX	Veracruz, Ver.
760	XEDGO	Durango, Dgo.
	XEABC	Los Reyes, D.F.
	XEZZ	Tonala, Jal.
790	XEBI	Aguascalientes, Ags.
	XERPC	Chihuahua, Chih.
	XEGZ	Ciudad Lerdo, Dgo.
	XENT	La Paz, B.C.
	XESU	Mexicali, B.C.
	XERC	Mexico City, D.F.
	XEFE	Nuevo Laredo, Tams.
	XEVA	Villahermosa, Tab.
800	XELO	Ciudad Juarez, Chih.
	XEAN	Ocotlan, Jal.
	XEMMM	Tijuana, B.C.
810	XEFW	Tampico, Tams.
	XEOE	Tapachula, Chis.
	XEUX	Tuxpan, Nay.
820	XEKG	Fortin de las Flores, Ver.
	XEBA	Guadalajara, Jal.
	XESB	Santa Barbara, Chih.
830	XELA	Mexico City, D.F.
	XENSM	Navolato, Sin.
840	XEFG	Celaya, Gto.
850	XEMIA	Chapala, Jal.
850	XEM	Chihuahua, Chih.
	XEUS	Hermosillo, Son.
	XEAL	Manzanillo, Col.
	XETQ	Orizaba, Ver.
	XEZR	Zaragoza, Coah.
860	XENW	Culiacan, Sin.
	XEDU	Durango, Dgo.
	XEUN	Mexico City, D.F.
	XENL	Monterrey, N.L.
	XEZX	Tenosique de Pino Suarez, Tab.
	XERK	Tepic, Nay.
	XEMO	Tijuana, B.C.
880	XEEM	Rio Verde, S.L.P.
	XETZ	Tequila, Jal.
900	XEW	Mexico City, D.F.
	XEWB	Veracruz, Ver.
910	XEHO	Ciudad Obregon, Son.
920	XEQD	Chihuahua, Chih.
	XELT	Guadalajara, Jal.
	XEBH	Hermosillo, Son.
	XEOK	Monterrey, N.L.
	XEMJ	Piedras Negras, Coah.
	XEBM	San Luis Potosi, S.L.P.
940	XEWV	Mexicali, B.C.
	XEQ	Mexico City, D.F.
	XERKS	Reynosa, Tams.
950	XERN	Montemorelos, N.L.
	XEYJ	Nueva Rosita, Coah.
950	XEGM	Tijuana, B.C.
960	XERGO	Chetumal, Q.R.
	XEGB	Coatzacoalcos, Ver.
	XEIQ	Cuidad Obregon, Son.
	XEHK	Guadalajara, Jal.
	XEOZ	Jalapa, Ver.
	XECS	Manzanillo, Col.
	XEMM	Morelia, Mich.
	XEK	Nuevo Laredo, Tams.
	XEUQ	Zihuatanejo, Gro.
970	XECJ	Apatzingan, Mich.
	XEJ	Cuidad Juarez, Chih.
	XEO	Matamoros, Tams.
	XEOW	Mazatlan, Sin.
	XEMH	Merida, Yuc.
	XEDF	Mexico City, D.F.
	XEVT	Villahermosa, Tab.
980	XELC	La Piedad, Mich.
	XEKE	Navojoa, Son.
	XENR	Nueva Rosita, Coah.
	XEQG	Queretaro, Qro.
	XETU	Tampico, Tams.
	XEXT	Tepic, Nay.
990	XEBC	Cuidad Guzman, Jal.
	XEHZ	La Paz, B.C.
	XECL	Mexicali, B.C.
	XET	Monterrey, N.L.
1000	XEFV	Ciudad Juarez, Chih.
	XEOY	Mexico City, D.F.
1010	XEWS	Culiacan, Sin.
	XEDX	Ensenada, B.C.
	XEHL	Guadalajara, Jal.
	XETX	Nuevo Casas Grandes, Chih.
	XEVK	Torreon, Coah.
	XEFM	Veracruz, Ver.
1020	XEXL	Patzcuaro, Mich.
1030	XEQR	Mexico City, D.F.
1050	XED	Mexicali, B.C.
	XEG	Monterrey, N.L.
1060	XEDP	Mexico City, D.F.
1070	XEIT	Ciudad del Carmen, Cam.
	XESP	San Pedro Tlaquepaque, Jal.
	XEGY	Tehuacan, Pue.
1090	XEWL	Nuevo Laredo, Tams.
	XERB	Tijuana, B.C.
	XEQD	Veracruz, Ver.
1110	XELEO	Leon, Gto.
	XERCN	Mexico City, D.F.
	XEOQ	Rio Bravo, Tams.
1120	XEUNO	Guadalajara, Jal.
1130	XEZL	Jalapa, Ver.
1140	XEXF	Leon, Gto.
	XEMR	Monterrey, N.L.
1150	XEAD	Guadalajara, Jal.
	XEJS	Hidalgo del Parral, Chih.
	XERTM	Macuspana, Tab.
	XERM	Mexicali, B.C.
	XEJP	Mexico City, D.F.
1150	XEBF	S. Pedro de las Colonias, Coah.
	XEXZ	Zacatecas, Zac.
1160	XEVW	Acambaro, Gto.
	XEJW	Uruapan, Mich.
1170	XERT	Reynosa, Tams.
1180	XEFR	Mexico City, D.F.

a DXer's OPEN SESAME to Old Mexico

MEXICAN MEDIUM-WAVE BROADCAST STATIONS

kHz.	Call	Location
1190	XEPZ	Ciudad Juarez, Chih.
	XEDO	Jojutla, Mor.
	XEMBC	Mexicali, B.C.
1200	XEZI	Zacapu, Mich.
1220	XEB	Mexico City, D.F.
1240	XELD	Autlan de Navarro, Jal.
	XEBN	Ciudad Delicias, Chih.
	XEBQ	Guaymas, Son.
	XENG	Huauchinango, Pue.
	XERZ	Leon, Gto.
	XES	Tampico, Tams.
	XELM	Tuxtla Guitierrez, Chis.
1250	XEDK	Guadalajara, Jal.
	XEDL	Hermosillo, Son.
	XEJX	Queretaro, Qro.
	XESJ	Saltillo, Coah.
	XEPI	Tixtla, Gro.
1260	XER	Linares, N.L.
	XEL	Mexico City, D.F.
	XEMF	Monclova, Coah.
	XEOG	Ojinaga, Chih.
1270	XERPL	Leon, Gto.
	XENX	Mazatlan, Sin.
1270	XEGL	Navojoa, Son.
	XENY	Nogales, Son.
	XEAX	Oaxaca, Oax.
	XEPV	Papantla de Clarte, Ver.
	XEMW	San Luis Rio Colorado, Son.
1280	XECAM	Campeche, Cam.
	XEBW	Chihuahua, Chih.
	XEZS	Coatzacoalcos, Ver.
	XEAG	Guadalajara, Jal.
	XEQP	Cordoba, Ver.
	XEAW	Monterrey, N.L.
1290	XEAP	Ciudad Obregon, Son.
	XEIX	Jiquilpan, Mich.
	XEDA	Mexico City, D.F.
1300	XEP	Ciudad Juarez, Chih.
	XESW	Ciudad Madera, Chih.
	XEJL	Guamuchil, Sin.
	XEHU	Martinez de la Torre, Ver.
	XEKW	Morelia, Mich.
	XELE	Tampico, Tams.
1310	XEFH	Agua Prieta, Son.
	XERU	Chihuahua, Chih.
	XETIA	Guadalajara, Jal.
	XEAM	Matamoros, Tams.
	XEVI	San Juan del Rio, Qro.
	XEPO	San Luis Potosi, S.L.P.
	XEBP	Torreon, Coah.
	XEHV	Veracruz, Ver.
	XEIZ	Villa de Guadalupe, N.L.
1320	XEUI	Comitan, Chris.
	XERJ	Mazatlan, Sin.
	XEAI	Mexico City, D.F.
	XENI	Nueva Italia, Mich.
	XEUH	Tuxepec, Oax.
1330	XEBO	Irapuato, Gro.
	XEUZ	Martinez de la Torre, Ver.
	XEFC	Merida, Yuc.
	XEWQ	Monclova, Coah.
1340	XEJK	Ciudad Delicias, Chih.
	XEBJ	Ciudad Victoria, Tams.
	XEGR	Coatepec, Ver.
	XEOM	Coatzacoalcos, Ver.
	XEMA	Fresnillo, Zac.
	XEDKT	Guadalajara, Jal.
	XECW	Los Mochis, Sin.
	XENV	Monterrey, N.L.
	XESL	San Luis Potosi, S.L.P.
1350	XEQK	Mexico City, D.F.
	XETM	Naco, Son.
	XEJF	Tierra Blanca, Ver.
	XETB	Torreon, Coah.
1360	XEY	Celaya, Gto.
	XESA	Culiacan, Sin.
	XEKF	Iguala, Gro.
	XEDQ	San Andres Tuxtla, Ver.
1370	XEA	Campeche, Cam.
	XEHF	Nogales, Son.
	XEPA	Puebla, Pue.
1380	XEGW	Ciudad Victoria, Tams.
1380	XECO	Mexico City, D.F.
1390	XEOR	Reynosa, Tams.
	XETY	Tecoman, Col.
	XETL	Tuxpan, Ver.
1400	XELH	Acaponeta, Nay.
	XEKJ	Acapulco, Gro.
	XEAC	Aguascalientes, Ags.
	XEPS	Empalme, Son.
	XEPB	Hermosillo, Son.
	XEGD	Hidalgo del Parral, Chih.
	XEI	Morelia, Mich.
	XEDE	Saltillo, Coah.
	XEAB	Santa Ana, Son.
	XETO	Tampico, Tams.
	XEVV	Tuxtla Gutierrez, Chis.
1410	XEKB	Atemajac, Jal.
	XECF	Los Mochis, Sin.
	XEBS	Mexico City, D.F.
	XEAS	Nuevo Laredo, Tams.
	XETAB	Villahermosa, Tab.
1420	XEF	Ciudad Juarez, Chih.
	XEWE	Irapauto, Gro.
	XEEW	Matamoros, Tams.
	XEH	Monterrey, N.L.
	XEWJ	Tehuacan, Pue.
	XEXX	Tijuana, B.C.
1430	XERAC	Campeche, Cam.
	XEMO	Ciudad Miguel Aleman, Tams.
	XEQX	Ciudad Obregon, Son.
	XEIG	Iguala, Gro.
1430	XELY	Morelia, Mich.
	XELL	Veracruz, Ver.
1440	XELZ	Mexico City, D.F.
1450	XECM	Ciudad Mante, Tams.
	XEDJ	Magdalena, Son.
	XEJM	Monterrey, N.L.
	XEPP	Orizaba, Ver.
	XEJD	Poza Rica, Ver.
	XENA	Queretaro, Qro.
	XEVH	Valle Hermoso, Tams.
1460	XEHE	Atotonilco El Alto, Jal.
	XEYC	Ciudad Juarez, Chih.
	XEHX	Ciudad Obregon, Son.
	XEJT	Tampico, Tams.
	XELX	Zitacuaro, Mich.
1470	XEHI	Ciudad Miguel Aleman, Tams.
	XEDS	Colima, Col.
	XEND	Durango, Dgo.
	XEYA	Irapauto, Gro.
	XESM	Mexico City, D.F.
	XEBBC	Tijuana, B.C.
1480	XEHM	Ciudad Delicias, Chih.
	XENS	Navojoa, Son.
	XEPR	Poza Rica, Ver.
	XETKR	Villa de Guadalupe, N.L.
1490	XEVZ	Acayucan, Ver.
	XEED	Ameca, Jal.
	XEDR	Guaymas, Son.
	XEMK	Huixtla, Chis.
1490	XEMS	Matamoros, Tams.
	XEFF	Matehuala, S.L.P.
	XEXE	Queretaro, Qro.
	XEGT	Zamora, Mich.
1500	XERH	Mexico City
1530	XEUR	Mexico City
	XESD	Silao, Gto.
1540	XENC	Celaya, Gto.
1550	XENU	Nuevo Laredo, Tams.
	XEBG	Tijuana, B.C.
1560	XEVIP	Mexico City, D.F.
1570	XERF	Ciudad Acuna, Coah.
1580	XELI	Chilpancingo, Gro.
	XEDM	Hermosillo, Son.
	XENQ	Tulancingo, Hgo.
	XEQL	Zamora, Mich.
1590	XENH	Escuinapa, Sin.
	XEVOZ	Mexico City, D.F.
	XEBZ	Villa de Meoqui, Chih.
1600	XEAE	Ciudad Acuna, Coah.

MEXICAN TV STATIONS

Channel	Call	Location
2	XHIA-TV	Torreon, Coah.
	XEPM-TV	Ciudad Juarez, Chih.
	XHCH-TV	Chihuahua, Chih.
	XEW-TV	Mexico City
	XEWO-TV	Guadalajara, Jal.
	XHI-TV	Ciudad Obregon, Son.
	XHFA-TV	Nogales, Son.
	XEFE-TV	Nuevo Laredo, Tams.
	XHFM-TV	Vera Cruz, Ver.
3	XHBC-TV	Mexicali, B.C.
	XHJMA-TV	Hgo. del Parral, Chih.
	XEZ-TV	El Zamorano, Gto.
	XEFB-TV	Monterrey, N.L.
	XHP-TV	Puebla, Pue.
	XHQ-TV	Culiacan, Sin.
	XHCV-TV	Coatzacoalcos, Ver.
	XHY-TV	Merida, Yuc.
4	XELN-TV	Torreon, Coah.
	XHTV	Mexico City
	XEG-TV	Guadalajara, Jal.
5	XHCC-TV	Colima, Col.
	XEJ-TV	Ciudad Juarez, Chih.
	XHFI-TV	Chihuahua, Chih.
	XHAJ-TV	Las Lajas, Ver.
	XHGC-TV	Mexico City
6	XETV	Tijuana, B.C.
	XHZ-TV	El Zamorano, Gto.
	XEHL-TV	Guadalajara, Jal.
	XET-TV	Monterrey, N.L.
	XEWH-TV	Hermosillo, Son.
7	XEX-TV	Paso de Cortes, Mex.
	XHMZ-TV	Mazatlan, Sin.
	XHGO-TV	Ciudad Madero, Tams.
8	XHAS-TV	Las Lejas, Ver.
9	XEQ-TV	Paso de Cortes, Mex.
	XHPT-TV	Merida, Yuc.
10	XHK-TV	La Paz, B.C.
	XHA-TV	Durango, Dgo.
	XHL-TV	Leon, Gto.
	XHKW-TV	Morelia, Mich.
	XHX-TV	Monterrey, N.L.
	XHAI-TV	Las Lajas, Ver.
11	XEIP-TV	Mexico City
	XEUS-TV	Hermosillo, Son
12	XEWT-TV	Tijuana, B.C.
	XHAW-TV	Monterrey, N.L.
	XHCG-TV	Los Mochis, Sin.
	XHOW-TV	Mazatlan, Sin.
13	XEW-TV	Aguascalientes, Ag.
	XHII-	Mexico City

MEXICAN FM STATIONS

kHz.	Call	Location
86.0	XHCM-FM	Cuernavaca, Mor.
90.5	XEDA-FM	Mexico, D.F.
92.1	XHFO-FM	Mexico, D.F.
92.5	XHSRO-FM	Monterrey, N.L.
93.3	XEH-FM	Monterrey, N.L.
93.7	XHNOE-FM	Nuevo Laredo, Tams.
95.3	XHSH-FM	Mexico, D.F.
97.1	XEBA-FM	Guadalajara, Jal.
97.9	XETIA-FM	Guadalajara, Jal.
98.1	XHMLS-FM	Matamoros, Tams.
98.5	XELA-FM	Mexico, D.F.
99.3	XHMS-FM	Monclova, Coah.
99.3	XEN-FM	Mexico, D.F.
100.1	XHMM-FM	Mexico, D.F.
100.3	XEAV-FM	Guadalajara, Jal.
100.9	XEOY-FM	Mexico, D.F.
101.9	XEAD-FM	Guadalajara, Jal.
103.3	XERPM-FM	Mexico, D.F.
104.9	XHRPE-FM	Mexico, D.F.
106.5	XHMR	Mexico, D.F.

wave is XERM, R. Mexico, which first came on the air last year on 9534 and 11,718 kHz. A government venture, R. Mexico seems conscious of its foreign listeners and occasionally announces in English, French, German.

Listeners reporting reception to Box 20100, Mexico City, have been receiving LP recordings of speeches by Mexico's president, but few QSLs, in return.

Also frequently heard on shortwave are XEQM, R. Yucatan, 6105 kHz, from Me-XEFT, La Voz de Veracruz, 9545 kHz; and XEWW, 9515 kHz, and XERR, 15,110 kHz, both from Mexico City. As with Mexico's medium-wave stations, shortwave reception is best during the evening hours, after 0000 GMT (7:00 p.m. EST).

Rough But Ready. A more exotic, but distinctly harder, way to log Mexico is on the TV and FM bands. On these very high fre-

(Continued on page 106)

MEXICAN SHORTWAVE STATIONS

kHz.	Call	Station Name	Location
2160	XEVJ	Radifusora XEVJ	Chilpancingo, Gro.
2380	XESE	Sta. de Educacion Publica	Samachique, Chih.
4820	XEJG	Gobierno del Est. de Jalisco	Guadalajara, Jal.
6010	XEOI	Radio Mil	Mexico, D.F.
6020	XEUW	El Eco de Sotavento	Veracruz, Ver.
6045	XEXQ	Radio Universidad	San Luis Potosi, S.L.P.
6065	XEXG	Radiodifusora Mexico	Leon, Gto.
6090*	XECMT	Radio Mante	Ciudad Mante, Tams.
6105	XEQM	Radio Yucatan	Merida, Yuc.
6115	XEUDS	Radio Universidae de Sonora	Hermosillo, Son.
6120	XETS	Radio Tapachula	Tapachula, Chis.
6165	XEWW	La Voz de la America Latina	Mexico, D.F.
6185	XEICM	La Voz del Maestro	Mexico, D.F.
9515	XEWW	La Voz de la America Latina	Mexico, D.F.
9534*	XERM	Radio Mexico	Mexico, D.F.
9545	XEFT	La Voz de Veracruz	Veracruz, Ver.
9555	XEQK	La Hora Exacta	Mexico, D.F.
9600	XEYU	Radio Universidad	Mexico, D.F.
11,718*	XERM	Radio Mexico	Mexico, D.F.
11,740	XEMP	La Charrita del Cuadrante	Mexico, D.F.
11,820	XEBR	El Heraldo de Sonora	Hermosillo, Son.
11,880	XEHH	Radiodifusora Comerciales	Mexico, D.F.
15,110	XERR	Radiodifusora Comerciales	Mexico, D.F.

*Frequency varies

QSL from Mexico City's XEB.

HAM TRAFFIC

DE W7DQS

by MARSHALL LINCOLN

Why DXCC Is Only The Beginning

LOOKING for a new award? Some hams, after making WAS, DXCC, and a bushel of county awards, seem to think they've conquered the world. They sort of slack off, as if there's nothing more worthy of their efforts. Actually, they're just beginning but haven't realized it.

For a new challenge, have you ever tried to get into the "A-1 Operator Club?" This is not something you apply for, or something you automatically obtain just by racking up a big score in a contest, or accumulating a tall stack of QSL cards. To become a member of the A-1 Operator Club, you just do one thing—*become an A-1 operator!*

Recognition that you have reached this level of competence will come when you are observed by other members of the Club and been nominated by at least two of them. They base their judgment on four basic items: 1) general keying and voice considerations, 2) correct use of operation procedures, 3) copying ability, and 4) judgment and courtesy.

Becoming a member isn't easy. But the honor is to be highly valued since it shows that the member has been recognized by other highly-qualified hams on the basis of his ability and on-the-air behavior and respect for his fellow hams. It's a goal for all of us to strive for. With each new member, ham radio is elevated another notch.

Let's Go To The Movies. *The* movie in this instance is called "Ham's Wide World," and it's a fascinating, well-organized 30-minute color film all about ham radio. You just might see it on your local TV station, or at a meeting of a civic group in your home town. And if it hasn't been shown there, you can help see to it that it is.

This film was produced by a professional film company hired by the ARRL as a public relations effort on behalf of ham radio. The folks involved did a really fine job. It's intended for showing to the general public—to people who have heard of ham radio, but never understood what it's all about.

All the actors are ordinary hams, going about all the things that hams across the country do. Narration is by two active hams who are well known to the general public: Barry Goldwater, K7UGA, and Arthur Godfrey, K4LIB.

Ham activities shown in the film include Field Day, DX rag chewing, technical experimenting, mobile operating, disaster communications, GI phone patches, and others. Each is explained in easily understandable, accurate terms. The narrative style should hold the attention of most anyone, regardless of his interest in the technical aspects of hamming.

If you want to help promote the advantages and value of ham radio among the general public, contact ARRL headquarters at Newington, Conn. 06111, or your own district ARRL director. A little effort on your part, and you should be able to arrange for a showing to a public meeting or on your local TV station.

Never Too Old. A letter from W9DIW comments on a previous Ham Traffic column in which I pointed out how ham radio benefits from those hams who make an extra effort to help their fellow hams. He says he knows firsthand what a wonderful thing that is. At the age of 67, W9DIW has obtained his Advanced Class license, thanks to W9SFU, who assisted a small group of fel-

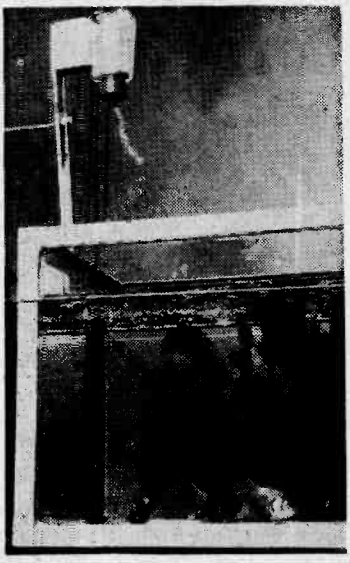
(Continued on page 101)

PHONE-FEEDING GOLDIE

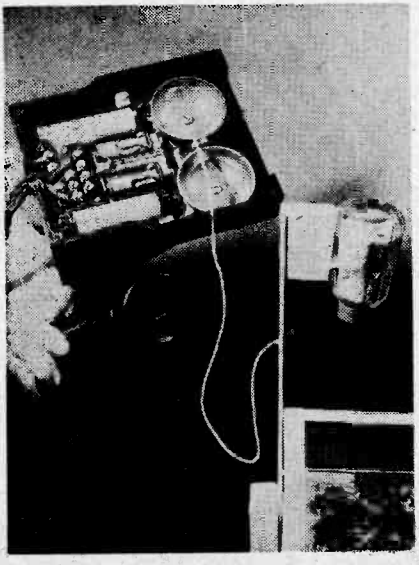
What to do when a vacation beckons and you can't find a living soul who's willing to feed your pet goldfish? O Problem, thy name is Pitilessness! Or is it? For if Rube Goldberg were around . . .

One answer, as shown in our photos, is the creation of England's Stan Lewis (above). What Stan did was to fix a supply of fish food to the top of a flexible bar attached to the side of the tank. This done, he ran a string from the bar to the hammer of his telephone bell and adjusted it so that ringing phone caused bar to shake and shaking bar caused fish food to fall.

When last heard from Stan was still on holiday. And Goldie, meanwhile, was munching merrily away. O Problem, thou art Powerless!—*Joe Gronk* ■



Under ever-present spell of gravity, fish food falls ever downward, unencumbered by resistance of air. Actuator is clapper of phone, which electrons cause to ring.



With bottom of phone removed, string can be seen running between clapper and bar. Not known is effect of Stan's friends' calls on gorgeous Goldie's gorging.

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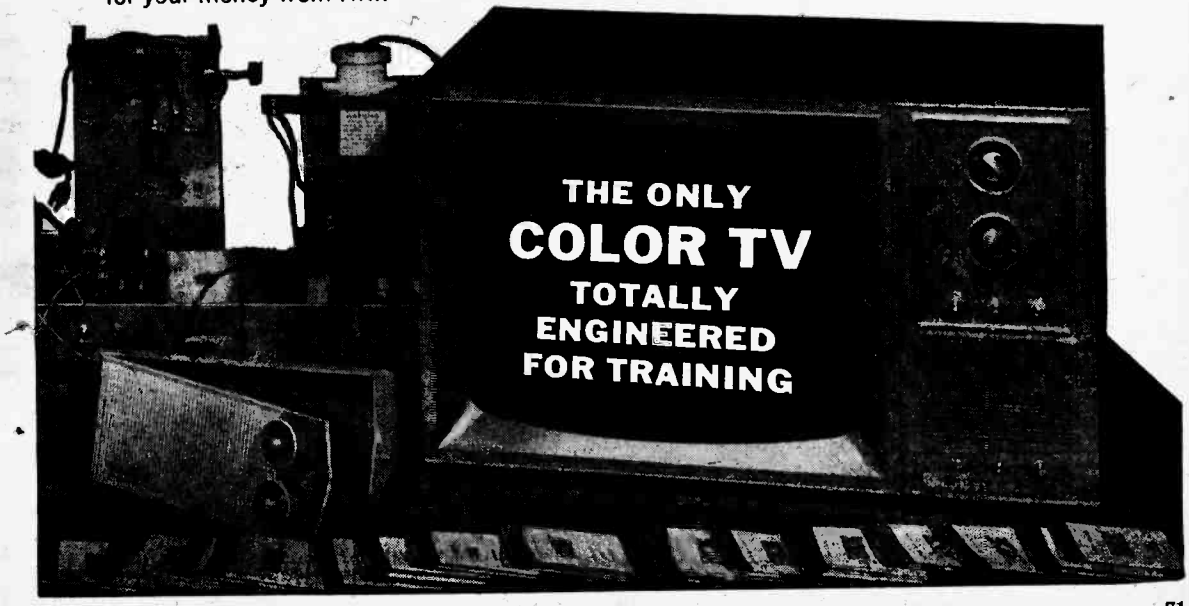
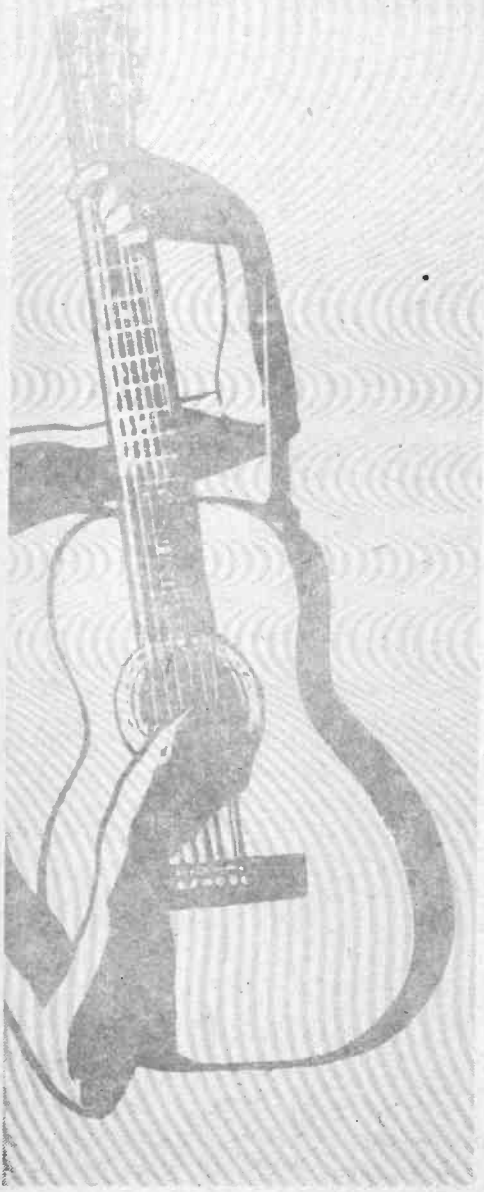


UNIJUNCTION tremolo

Adds Rock Beat to Your Guitar



by Steve Daniels, WB2GIF

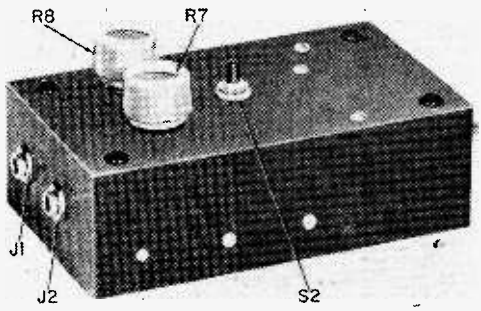
THE mournful throbbing and fast go-go effects that can be produced by an electronic tremolo make it a favorite instrument of rock groups to add interest to the sound of a guitar or organ. Unfortunately, many of these devices now commercially available produce a thumpy or choppy effect because the sound is modulated by heavy or sharp pulses. Most amps, especially bass amps, don't have a built-in tremolo circuit: therefore, our Unijunction Tremolo adds this refinement to help make your group an outstanding one.

How It Works. The basic unit of our Tremolo is a low-speed relaxation oscillator built around Q1, a unijunction transistor. Resistors R1 and R2 limit the fast and slow rates. Positive pulses, appearing on b1 of the UJT are coupled to the base of Q2, a common emitter amplifier, via C2 and R7. Lamp I1 is connected to the collector of Q2, which is slightly forward biased by R5. The lamp flashes on and off, following the pulses created by Q1. The thermal lag, inherent in incandescent lamps, reduces the thumping effect. Lamp I1 excites photocell PC1, charging capacitor C3. PC1 and C3 are connected to the output of the musical instrument (guitar, organ, etc.) and the input of the amplifier. As C3 is discharged across the input

UNIJUNCTION tremolo

to the amplifier it momentarily bypasses the musical instrument output to ground. Each flash of the lamp recharges the capacitor, thus producing the smooth tremolo effect.

Although total current drain of the *Tremolo* is quite small (it actually could be operated from a 9-volt transistor radio battery with relatively long battery life) we have included a self-contained power supply to permit operation directly from the AC



Here's operating panel of our Unijunction Tremolo. Switch S2 lets you turn off tremolo effect anytime you want just plain old music without benefit of trembling tremolo.

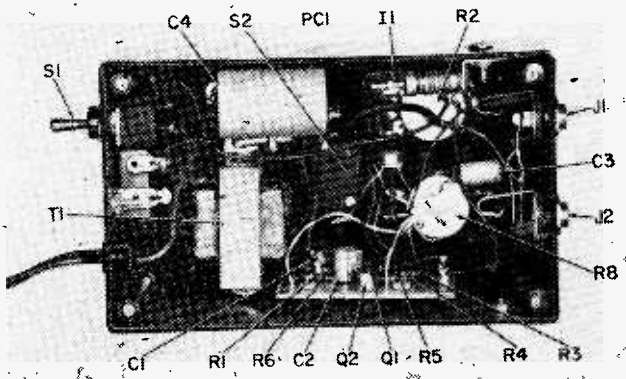
power line. In the schematic we show where the battery is connected in the event you may prefer operating your *Tremolo* from a battery. Initial cost for the battery-operated version is less than for the power line operated one.

Let's Make It. In spite of the fact that we built a 117-V, 50-60 Hz power supply into the unit, we were able to house the *Tremolo* in a small (3¾ x 6¼ x 2-in.) plastic instrument case. The power supply is assembled in one third of the pastic box, leaving the balance of the space available for the electronic portion. Transistors, coupling capactiors, and resistors are mounted on a 1¼ x 2½-in. piece of perfboard, which is fastened to one of the side walls inside the case. Flea clips or push pins are used to mount these components and make connections to them.

Exciter lamp I1 is fastened to the opposite side wall and jacks J1 and J2 are mounted on one end. Photocell PC1 is self-supporting on its pigtails and is positioned about an inch or inch-and-a-half away from its exciter lamp I1. For best results, you may have to push it around and/or vary the distance from the lamp by bending the leads. Mount power switch S1 on the end opposite to that holding the jacks and also drill a hole in this end for the power cord.

Potentiometers R2 and R7, as well as switch S2, are mounted on the base (which thereby converts it to be the front panel) of the plastic box, conveniently grouped nearer the end of the box holding the jacks. Power transformer T1 is mounted on the base of the plastic box as far as possible away from the input jacks, as are tie strips for holding rectifier diode D1, R9, C4, and power cord.

Preliminary check. Before tightening down the perfboard you will want to check out the flashing rate of exciter lamp I1. As stated earlier, the upper and lower limits of speed of oscillation (frequency) of the relaxation oscillator can be changed by varying the value of R1 for high rate, and R6



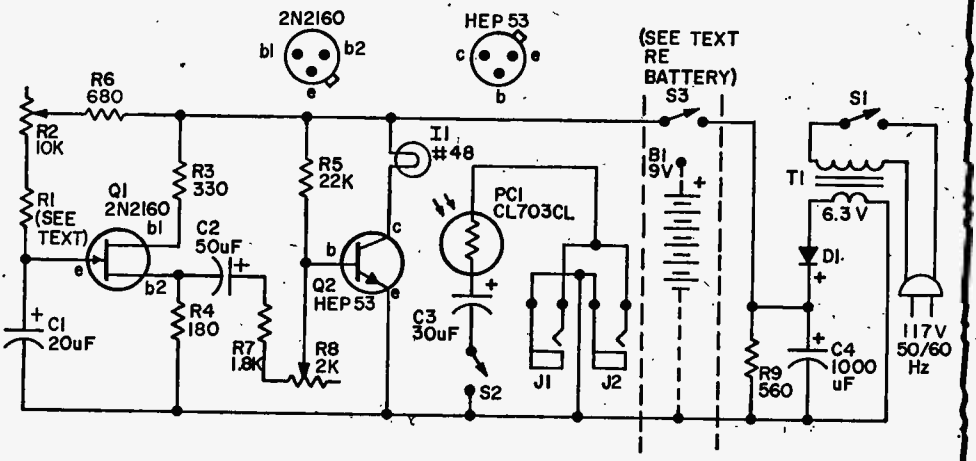
You must admit there's lots of parts crammed inside our box. After all, we do need a power supply as well as the UJT circuitry and photocell control unit. Photocell is suspended in space about an inch from lamp I1. Connection leads of photocell are stiff enough to hold it in position.

for low rate. As a preliminary adjustment, start initially with a 2700-ohm resistance value for R1 and substitute both higher and lower values until you have a maximum speed to meet your requirements. Of course, potentiometer R2 is set for maximum speed before making any substitutions. One you've adjusted the pulse rate to your satisfaction, fasten down the perfboard and you are ready to try your hand at tremolo-ing.

Let's Use It. The *Tremolo* is very easy to use. Just plug your guitar, or other musical instrument, pickup into J1, and plug into J2 the input to your amplifier. Connect the UJT Tremolo to the power line and turn *on* power switch S1. Initially set both controls to midpoint. Make certain that push switch S2 is turned *on* by observing that lamp I1 is flashing. You adjust the rate of flash by rotating the left hand knob (R2) and the intensity by rotating the right hand knob (R5).

You may want to calibrate the pulse rate knob. This can be done easily by counting the number of pulses in a given time period (e.g., one minute) and marking the position of the knob on the face of the plastic case. You can use transfer letters (Datak or equiv.) to indicate calibration count.

If you want certain passages to be amplified without tremolo, just push switch S2 to the *off* position. When you give it a second push the Unijunction Tremolo is back in business again. ■



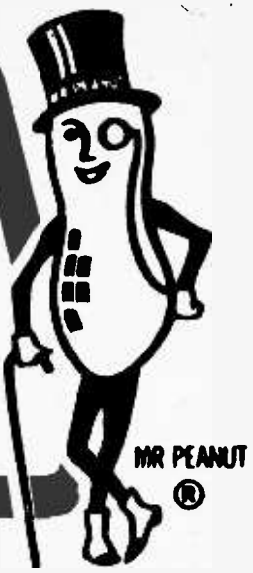
PARTS LIST FOR UNIJUNCTION TREMOLO

C1—20-uF, 15-VDC electrolytic capacitor (Lafayette 34E85489 or equiv.)
C2—50-uF, 15-VDC electrolytic capacitor (Lafayette 34E85521 or equiv.)
C3—30-uF, 15-VDC electrolytic capacitor (Lafayette 34E85505 or equiv.)
C4—1000-uF, 15-VDC electrolytic capacitor (Lafayette 34E55177 or equiv.)
D1—50-PIV, 750-mA silicon rectifier (Lafayette 19E50070 or equiv.)
I1—#48 pilot lamp, 2-V, 0.06-A (Lafayette 32E66202 or equiv.)
J1, J2—Open circuit phone jack (Lafayette 99E62135 or equiv.)
PC1—Photoelectric cell, Clairex CL703L (note: do not use any other type or number as circuit is designed around resistance of this cell)
R1—2700-, 3900-, or 4700-ohm, ½-watt resistor (see text regarding choice of values)
R2—10,000-ohm, linear potentiometer (Lafayette 33E11255 or equiv.)
R3—330-ohm, ½-watt resistor
R4—180-ohm, ½-watt resistor
R5—3300-ohm, ½-watt resistor
R6—680-ohm, ½-watt resistor
R7—1800-ohm, ½-watt resistor
R8—2000-ohm, linear potentiometer (Lafayette 33E11172 or equiv.)
R9—560-ohm, ½-watt resistor
S1—Spst toggle switch (Lafayette 34E33026 or equiv.)
S2—Spst push-for-on, push-for-off switch (as in table lamps, available from hardware store)
T1—Power transformer: 117-V, 50-60-Hz pri.; 6.3-V, 0.6-A sec. (Lafayette 33E80490 or equiv.)
1—Pilot lamp socket, miniature screw base with mounting bracket (Lafayette 32E28038 or equiv.)
1—6¼ x 3¾x2-in. plastic instrument case with blank cover (Lafayette 19E20016 case, 19E37010 blank panel or equiv.)
1—Power cord and plug

Misc.—Perfboard, push pins or flea clips, wire, solder, tie strips, screws, nuts, ¼-in. spacers, etc.

NutZee

A taste treat for your ears!



by Capt. James E. Lockridge

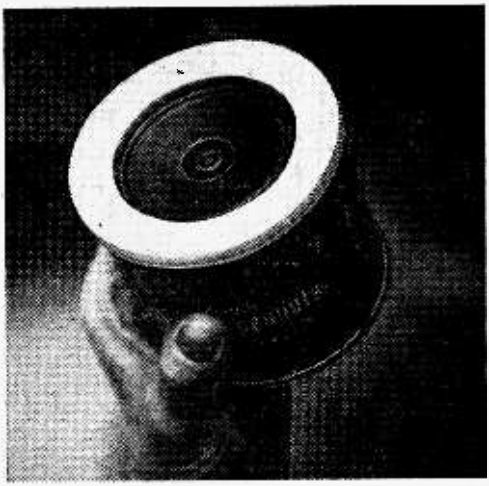
Now you can install speakers everywhere in your home for less than a buck each—providing that you can be talked into eating a certain brand of peanuts. NutZee, our super-cheap speaker, goes together in 10 to 15 minutes and provides outstanding fidelity and volume considering its size and cost. NutZees can be hooked into your stereo system or used as simple auxiliary speakers for your personal radio or transistor portable. The author happily uses his with a Roberts 770X tape recorder and also with a table radio.

What It Is. Heart of our NutZee is a 2½-in. dia. transistor radio replacement speaker. This is cleverly mounted inside a Planters peanut can, serving the dual role of an effective baffle and enclosure for the speaker. The entire assembly is fitted with a subminiature phone jack; NutZee goes anywhere in your home. And finally, it needs only a length of zip cord to your music system before you lean back and enjoy it.

How to Make It. First step is to solder a 10-in. length of zip cord to the speaker lugs. Then, place the speaker face down on the middle of the plastic cover top (supplied with every can of Planters) and trace the circumference of the speaker on the plastic with a ballpoint pen. Next, remove the speaker and carefully draw another circle ⅛-in. smaller inside the first one.

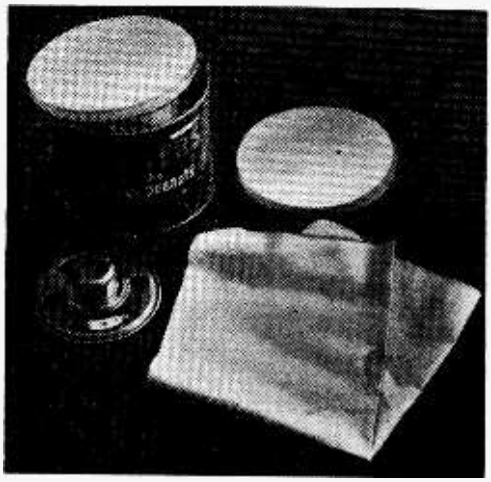
Using the point of a pair of scissors, punch a hole in the center of the plastic. Carefully cut your way to the inner circle; cut it out, and what you're left with is a ⅛-in. lip for mounting the speaker. Use a good brand of epoxy cement—the kind where you have to mix tubes A and B—and cement the speaker to the plastic top. Put the plastic top-speaker assembly aside to dry. While the epoxy compound is curing is a good time to mount the jack in the can.

(The plastic-top/speaker assembly will later be snapped into place on the peanut can so make sure that in mounting the speaker to the plastic you join them on the correct side. This is the one where the out-



Here's NutZee before finishing touches are applied. For effect, try painting plastic top matte black. Your friends will search high-and-low trying to find camouflaged NutZee!

NutZee



NutZee's major ingredients. Cloth covers speaker/plastic top assembly on author's NutZee; this pretties up NutZee and protects speaker cone from dust and prying fingers.

side flange of the plastic is facing towards the speaker.)

Drill a clearance hole ½-in. from the can bottom. Next, deburr the edge of the hole with a round file so the jack will mount cleanly. After the jack has been installed, you're ready to solder the speaker leads to it. Snap the plastic-top/speaker assembly into place and you're all set to finish NutZee.

NutZee can either be spray painted or covered with vinyl contact paper. Whichever you use, there are many colors and patterns to choose from to suit the decor of your home.

PARTS LIST FOR NUTZEE

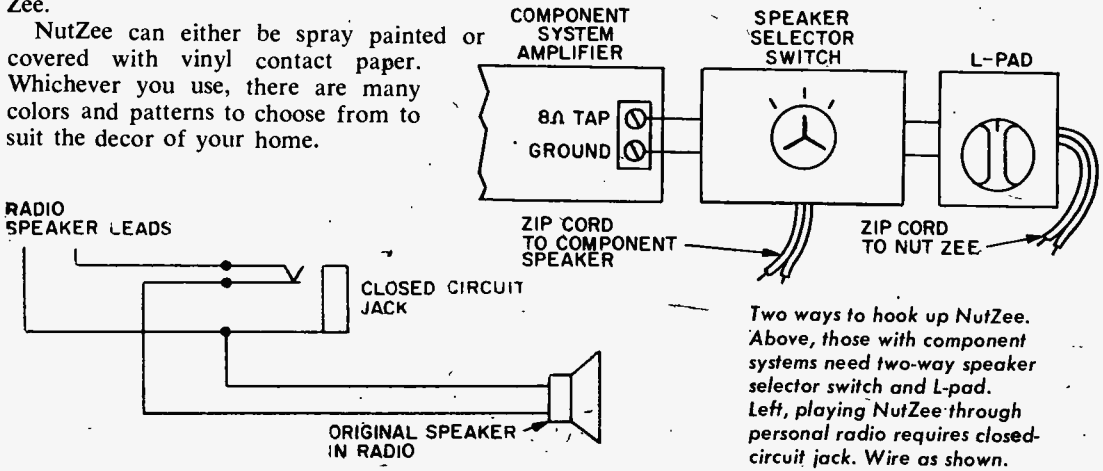
1—2½-in. dia., 8-ohm loudspeaker (Lafayette 99E60386 or equiv.)
1—6¾-oz. size Planters peanuts can with plastic snap top
1—Subminiature open circuit phone jack (Lafayette 99E62119 or equiv.)
1—Subminiature phone plug (Lafayette 99E62101 as required, or equiv.)
1—8-ohm L-pad (Lafayette 99T6134 or equiv.)
1—Remote speaker switch (see text)
Misc.—Zip cord, paint or vinyl, epoxy, solder, etc.

Broadening Your Music. You'll want to use your NutZees as auxiliary speakers for your table radios, or your stereo system. But first a word of caution. Do *not* use your NutZees with an AC/DC radio; a shock hazard may be present and could prove lethal. Some stereo systems have a couple of jacks marked *aux. speakers.* These jacks, when used with mating phone connectors, will disconnect the manufacturer's speakers from the set and give you the freedom to connect other external speakers.

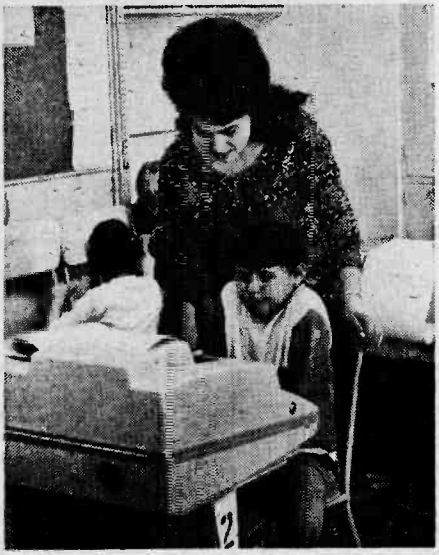
After you've found a good place to put NutZee, solder the appropriate phone plugs to suitable lengths of zip cord. Make sure that the power is *off* when plugging or unplugging any speaker, since the transients caused may damage the output tubes or transistors in the set.

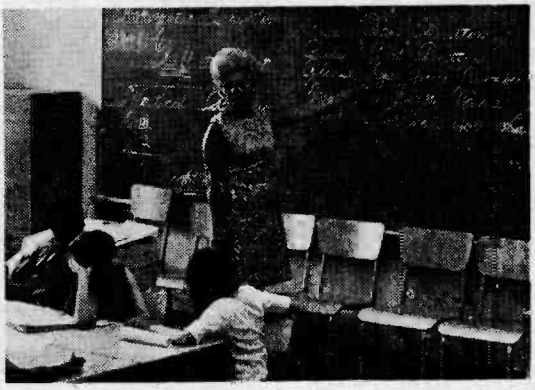
To use your NutZees with a personal radio (*not* an AC/DC set) or a portable, follow the same procedure and again make sure that the radio is turned off when NutZee is plugged in or out. If your radio has no jack for an external or auxiliary speaker connection, then you'll have to wire

(Continued on page 102)

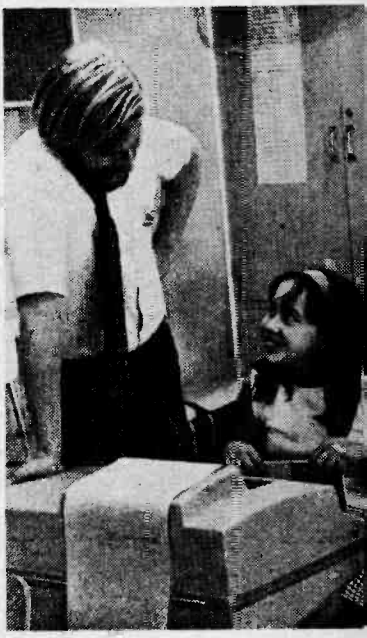


Two ways to hook up NutZee. Above, those with component systems need two-way speaker selector switch and L-pad. Left, playing NutZee through personal radio requires closed-circuit jack. Wire as shown.



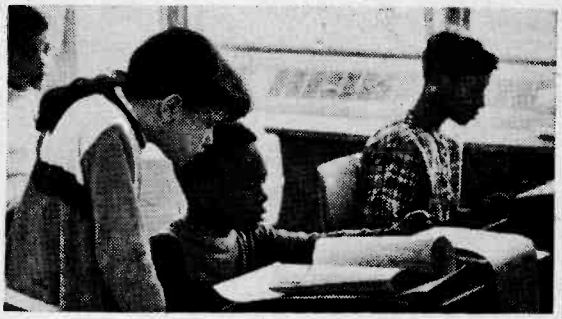


COMPUTERS VS. TEACHERS



Originally intended as another tool to aid the teacher, the computer now threatens to replace him as well. Item: over 3000 pupils now find themselves mug-to-readout panel with a computer in New York City's elementary schools. Called Computer Assisted Instruction (CAI), the system brings modern technology to the aid of the teacher. It consists of 192 student terminals (i.e., teletype machines) connected by special lines to an RCA Spectra 70/45 computer located in midtown

COMPUTERS vs. TEACHERS



Manhattan. Currently programmed only for teaching arithmetic, the computer sends out drill problems, judges the pupils' answers, and records their scores, all in a split second. In essence the computer is the brains —teacher, if you will—of the system.

According to the Central Computer Facility, installers of the CAI machines, they are designed "to ask the student a question hard enough to make him work, but not too hard for him to answer, and based on the student's previous performance. The computer selects the appropriate level of difficulty for each student and guides him on an individual path of learning. Each student receives daily lessons geared to his own progress and learning ability."

Way in which a student takes a lesson is described by the company, "When a student's turn comes to run the system he goes to a convenient terminal and pecks out a number and his first name on the terminal keyboard. The system then identifies the student and confirms it by typing out his family name. In a split second the computer checks its memory stores, determines from the student's previous performance what lesson he is to study, and begins the day's lesson. As the student answers the problems or questions given him, the system helps him correct his errors, giving him a second chance, and ends the lesson by telling him how well he did. Each lesson lasts for 8 to 12 minutes and the student tears off the graded lesson, or printout, to keep."

How do the pupils take to this new teacher? Some flip over it like flipping were going out of style, others remain stolidly unmoved. According to Cornelius Butler, director of the CAI program, "It's silly to think that there's any sort of alienation between pupil and machine. The kids know they are working with a machine and they're enthusiastic about it. One reason is that they seem to know intuitively that this is a fair system, that there is no possibility of partiality or favoritism."

He concludes by saying that "In 25 years every urban community will have at least one computer project where kids can have access to files of information on any subject, and will use satellites to convey this information. But no matter how far we go, we'll always need teachers." ■

VOLUME 52, PART 3

WHITE'S RADIO LOG

An up-to-date Directory of North American AM, FM, and TV Stations, including special sections on World-Wide Shortwave Stations and Emergency Stations for Selected Areas

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WHITE'S

RADIO LOG

U. S. AM Stations by Location

Listing Indicates stations on the air up to February 14, 1970

Location	C.L.	kHz
Abbeville, Ala.	WARI	1480
Abbeville, La.	KROF	960
Abbeville, S.C.	WABV	1590
Aberdeen, Md.,	WAMD	970
Aberdeen, Miss.	WMPA	1240
Abedreen, S.Dak.	KSDN	930
	KABR	1420
	KXRO	1320
Aberdeen, Wash.	KBKW	1450
	KXRO	1320
Abilene, Tex.	KRBC	1470
	KCAD	1560
	KNIT	1280
	KWKC	1340
Abilene, Kansas	KABI	250
Abingdon, Va.	WBBI	1230
Ada, Okla.	KADA	1230
Adel, Ga.	WBIT	1470
Adrian, Mich.	WABJ	1490
Agana, Guam	KNAH	610
Aguadilla, P.R.	WABA	850
	WGRF	1340
Ahoskie, N.C.	WRCS	970
Aiken, S.C.	WAKN	990
	WLAW	1300
Ainsworth, Neb.	KBRB	1440
Aitkin, Minn.	KKIN	930
Akron, Ohio	WAKR	1590
	WSLR	1350
	WCUE	1150
	WHLO	640
Alamogordo, N.M.	KALG	1230
	KINN	1270
Alamo Heights, Tex.	KDRY	1110
Alamosa Colo.	KGIW	1450
Albany, Ga.	WALG	1590
	WJAZ	960
	WLYB	1250
	WGPC	1450
	WJAZ	960
Albany, Ky.	WANY	1390
Albany, Minn.	KASM	1150
Albany, N.Y.	WABY	1400
	WOKO	1460
	WPTR	1540
	WROW	590
Albany, Oreg.	KWIL	790
	KRKT	990
Albermarle N.C.	WABZ	1010
	WZKY	1580
Albert Lea, Minn.	KATE	1450
Albertville, Ala..	WAVU	630
Albion, Mich.	WALM	1260
Albuquerque, N.M.	KABQ	1350
	KDEF	1150
	KGGM	610
	KHIP	1520
	KOB	770
	KPAR	1190
	KQEO	920
	KRZY	1450
	KDAZ	730
	KZIA	1580
	KRZY	1450
Alcoa, Tenn.	WEAG	1470
Alexander City, Ala.	KRZY	1450
	WRFS	1050
Alexandria, La.	KALB	580
	KDBS	1410
	KSYL	970
Alexandria, Minn.	KXRA	1490
Alexandria Va.	WPIK	790
Algona, Iowa	KLGA	1600
Alice, Tex.	KOPY	1070
Alisal, Cal.	KRSA	1570
Allendale, S.C.	WDOG	1460
Allentown, Pa.	WHOL	1600
	WAEB	790
	WKAP	1320
	WSAN	1470
Alliance, Nebr.	KCOW	1400
Alliance, Ohio	WFAH	1310
Alma, Ga.	WULF	1400
Alma, Mich.	WFYC	1280
Alpena Township, Mich.	WATZ	1450
Alpine, Tex.	KVLF	1240
Altavista, Va.	WKDE	1000
Alton, Ill.	WOKZ	1570
Altoona, Man.	CFAM	1290
Altoona, Pa.	WFBG	1290
	WRTA	1240
	WVAM	1430
Alturas, Calif.	KCNO	570
Altus, Okla.	KWHW	1450
Alva, Okla.	KALV	1430
Amarillo, Tex.	KDJW	1010
	KPUR	1440
	KGNC	710
	KIXZ	940
	KRAY	1360
	KZIP	1310
Ambridge, Pa,	WMBA	1460
Americus, Ga.	WDEC	1290
	WISK	1390
Ames, Iowa	KASI	1430
	WOI	640
Amherst, Mass.	WTTT	1430
Amherst, N.S.	CKDH	1400
Amherst, N.Y.	WUFO	1080
Amite, La.	WABL	1570
Amory, Miss.	WAMY	1580
Amsterdam, N.Y.	WKOL	1570
	WCSS	1490
Anaconda, Mont.	KANA	580
Anacortes, Wash.	KAGT	1340
Anaheim, Calif.	KEZY	1190
Anchorage, Alaska	KBYR	1270
	KFQD	750
	KENI	550
	KHAR	590
	KYAK	650
Andalusia Ala.	WCTA	920
	WAAO	1530
Anderson, Cal.	KMRE	1580
Anderson Ind.	WHUT	1470
	WHBU	1240
Anderson, S.C.	WAIM	1230
	WANS	1280
Andrews, Tex.	KACT	1190
Annapolis, Md.	WANN	1190
	WYRE	810
	WNAV	1430
Ann Arbor, Mich.	WAAM	1600
	WPAG	1050
Anna, Ill.	WRAJ	1440
Anniston, Ala.	WANA	1490
	WDNG	1450
	WHMA	1390
Annville-Cleona, Pa.	WAHT	1510
Anoka, Minn.	KANO	1470
Ansonia, Conn.	WADS	690
Antigo, Wis.	WATK	900
Apollo, Pa.	WAVL	910
Apopka, Fla.	WTLN	1520
Apple Valley, Cal.	KAVR	960
Appleton, Wis.	WAPL	1570
	WHBY	1230
Aquadilla, P. R.	WUNA	1340
Arab, Ala.	WRAB	1380
Arcadia, Fla.	WAPG	1480
Arcata, Calif.	KENL	1340
	KATA	1340
Ardmore, Okla.	KVSO	1240
	KATA	1340
Ardmore, Okla.	KVSO	1240
Ardmore Tenn.	WSLV	1110
Arecibo, P.R.	WCMN	1280
	WMIA	1070
	WNIK	1230
Argentia, Nfld.	VOUS	1480
Arkadelphia, Ark.	KVRC	1240
Arkan. City, Kans.	KSOK	1280
Arlington, Fla.	WDCJ	1220
	WEAM	1390
Arroyo Grande, Calif.	KOAG	1280
Artesia, N.M.	KSVP	990
	KOAG	1280
Artesia, N.M.	KSVP	990
Arvada, Colo.	KQXI	1550
Ashburn, Ga.	WMES	1570
Asbury Park, N.J.	WJLK	1310
Asbury Park-Eatontown, N. J.	WHTG	1410
Asheboro, N.C.	WGWR	1260
Asheville, N.C.	WISE	1310
	WKKE	1380
	WSKY	1230
	WWNC	570
Ashland, Ky.	WCMI	1340
	WTCR	1420
Ashland, Ohio	WNCO	1340
Ashland, Ore.	KWIN	580
	KRVC	1350
Ashland, Va.	WIVE	1430
Ashland, Wis.	WATW	1400
Ashtabula, Ohio	WAQI	1600
	WREO	970
Aspen, Colo.	KSNO	1280
Astoria, Oreg.	KAST	1370
	KVAS	1230
Atchinson, Kans.	KARE	1470
Athens, Ala.	WKAC	1080
Athens, Ga.	WGAU	1340
	WDOL	1470
	WDOL	1470
	WKAC	1080
	WRFC	960
	KQXI	790
Athens, Ohio	WATH	970
	WOUB	1340
Athens, Tenn.	WLAR	1450
	WYXI	1390
Athens. Tex.	KBUD	1410
Atlanta, Ga.	WPLO	590
	WIGO	1340
	WAOK	1380
	WERD	860
	WGKA	1190
	WGST	920
	WGUN	1010
	WIIN	970
	WQXI	790
	WSB	750
	WYZE	1480
Atlanta-Decatur, Ga.	WGUN	1010
Atlanta, Tex.	KALT	900
Atlantic, Iowa	KJAN	1220
Atlantic Beach, Fla.	WKTX	1600
Atlantic City, N.J.	WFPG	1450
	WLDB	1490
	WMID	1340
Atmore, Ala.	WATM	1590
Atoka, Okla.	KEOR	1110
Attleboro, Mass.	WARA	1320
Auburn, Ala.	WAUD	1230
Auburn, Calif.	KAHI	950
Auburn, Ind.	WIFF	1570
Auburn, Me.	WPNO	1530
Auburn, N.Y.	WMBO	1340
	WAUB	1590
Auburn, Wash.	KASY	1220
Auburndale, Fla.	WTWB	1570
Auburndale, Wis.	WLBL	930
Augusta, Ga.	WAUG	1050
Augusta, Ark.	KMCW	1190
	WBBQ	1340
	WBIA	1230
	WGAC	580
	WRDW	1480
	WTHB	1550
Augusta, Maine	WRDO	1400
	WFAU	1340
Aurora, Colo.	KOSI	1430
Aurora, Ill.	WMRO	1280
	WKKD	1588
Aurora, Mo.	KSWM	940
Austell, Ga.	WACX	1600
Austin, Minn.	KAUS	1480
	KQAQ	970
Austin, Tex.	KNOW	1490
	KTAP	970
	KTBC	590
	KOKE	1370
	KVET	1300
	KSOA	1430
	KBIG	740
Ava, Mo.	WAVO	1420
Avalon, Cal.	WAVP	1390
Avondale Estates, Ga.	KHAP	1340
Avon Park, Fla.	WBAB	1440
Aztec, N. Mex.	WGLI	1290
Babylon, N.Y.	WLEW	1340
Bad Axe, Mich.	WMGR	930
Bainbridge, Ga.	WAZA	1360
	KFLN	960
Baker, Mont.	KBKR	1490
Baker, Oreg.	KAFY	550
Bakersfield, Calif.	KBIS	970
	KERN	1410
	KGEE	1230
	KUZZ	800
	KLYD	1350
	KWAC	1490
	KPMC	1560
Bellingham, Wash.	KPUG	1170
Baldwinsville, N.Y.	WSEN	1050
Ballinger, Tex.	KRUN	1400
Baltimore, Md.	WBAL	1090
	WAYE	860
	WBMD	750
	WCAO	600
	WCBM	680
	WEBB	1360
	WFBR	1300
	WITH	1230
	WSID	1010
	WWIN	1400
Bamberg-Denmark, S.C.	WWBD	790
Bangor, Maine	WABI	910
	WGUY	1250
	WLBZ	620
Banning, Calif.	KPAS	1490
Baraboo, Wis.	WBOO	740
Bardstown, Ky.	WBRT	1320
Barbourville, Ky.	WYMX	950
Barnesville, Ga.	WBAF	1090
Barnwell, S.C.	WBAW	740
Barre, Vt.	WSNO	1450
Barstow, Calif.	KWTC	1230
	KIOT	1310
Bartlesville, Okla.	KWON	1400
Bartow, Fla.	WBAR	1460
	WPUL	1130
Bassett, Va.	WODY	900
Bastrop, La.	KTRY	730
	KVOB	1340
Batavia, N.Y.	WBTA	1490
Batesburg, S.C.	WBLR	1430
Batesville, Ark.	KBTA	1340
Batesville, Miss.	WBLE	1290
Bath, Maine	WJTD	730
Bath, N.Y.	WFSR	1580
Baton Rouge, La.	WAIL	1260
	WLUX	1550
	WYNK	1380
	WIBR	1300
	WJBO	1150
	WLCS	910
	WXOK	1460
Battle Creek, Mich.	WBCK	930
	WKFR	1400
	WVOC	1500
Baxley, Ga.	WUFE	1260
Bayard, N.M.	KNFT	950
Bay City, Mich.	WBCM	1440
	WXOX	1250
Bay City, Tex.	KIOX	1270
Bay Minette, Ala.	WBCA	1110
Bayamon, P.R.	WLUZ	1600
	WRSJ	1560
Baytown, Tex.	KWBA	1360
Beacon, N.Y.	WBNR	1260
Beardstown, Ill.	WRMS	790
Beatrice, Nebr.	KWBE	1450
Beaufort, N.C.	WBMA	1400
Beaufort, S.C.	WBEU	960
	WSIB	1480
Beaumont, Tex.	KLVI	560
	KAYC	1450
	KJET	1380
	KTRM	990
Beaver Dam, Wis.	WBEV	1430
Beaver Falls, Pa.	WBVP	1230
Beckley, W. Va.	WJLS	560
	WCIR	1070
	WWNR	620
Bedford, Ind.	WBIW	1340
Bedford, Pa.	WBFD	1310
Bedford, Va.	WBLT	1350
Beeville, Tex.	KIBL	1490
Bel Air, Md.	WVOB	1520
Belen, N. Mex.	KARS	860
Belfast, Me.	WBME	1230
Belgrade, Mont,	KGVW	630
Bellaire, Ohio	WOMP	1290
Bellefontaine, O.	WTOO	1390
Bellefonte, Pa.	WBLF	970
Bell Fourche, S.Dak.	KBFS	1450
Belle Glade, Fla.	WSWN	900
Belleville, Ont.	CJBQ	800
Belleville, Ill.	WIBV	1260
Bellevue, Wash.	KBVU	1540
Bellingham, Wash.	KPUG	1170
	KGMI	790
	KBQT	1550
	KBFW	930
Belmont, N.C.	WCGC	1270
Beloit, Wis.	WGEZ	1490
	WBEL	1380
Belton, S.C.	WHPB	1390
Belton, Tex.	KTON	940
Belzoni, Miss.	WELZ	1460
Bemidji, Minn.	KBUN	1450
Bend, Oreg.	KBND	1110
	KGRL	940
Bennetsville, S.C..	WBSC	1550
Bennington, Vt.	WBTN	1370
Benson, Minn.	KBMO	1290
Benson. N.C.	WPYB	1130
Benton, Ark.	KBBA	690
	KGKO	850
Benton, Ky.	WCBL	1290
Benton Harbor-St. Joseph, Mich.	WHFB	1060
Berkeley, Calif.	KPAT	1400
Berkeley Springs, W.Va.	WCST	1010
Berlin, N.H.	WMOU	1230
	WBRL	1400
Berlin Wis.	WISS	1090
Berry Hill. Tenn.	WVOL	1470
Berryville, Ark.	KTHS	1480
Berwick, Pa.	WBRX	1280
Bessemer, Ala.	WYAM	1450
Bethesda, Md.	WGMS	570
	WUST	1120
Bethlehem, Pa.	WGPA	1100
Beverly, Mass.	WMLO	1570
Biddeford, Maine	WIDE	1400
Big Bear Lake, Cal.	KTOT	1050
Big Delta, Alaska	WXLL	980
Big Lake, Tex.	KWGH	1290
Big Rapids, Mich.	WBRN	1460
Big Sprg., Tex.	KBST	1490
	KHEM	1270
	KBYG	1400
Big Stone Gap. Va.	WLSD	1220
Biloxi, Miss.	WLOX	1490
	WVMI	570
Billings, Mont,	KBMY	1240
	KGHL	790
	KOOK	970
	KOYN	910
	KURL	730
Binghamton, N.Y.	WINR	680
	WKOP	1360
	WNBF	1290

Location	C.L.	kHz
Birmingham, Ala.	WAPI	1070
	WBRC	960
	WCRT	1260
	WAQY	1220
	WENN	1320
	WATV	900
	WSGN	610
	WYDE	850
	WVOK	690
Bishee, Arlz.	KSUN	1230
Bishop, Calif.	KIBS	1230
Bishopville, S.C.	WAGS	1380
Bismarck, N.Dak.	KFYR	550
	KBMR	1350
Bismarck-Mandan, N. Dak.	KBOM	1270
Black Mountain, N.C.	WBMS	1350
	WFGW	1010
Black River Falls, Wis.	WWIS	1260
Blackfoot, Idaho	KBLI	690
Blacksburg, Va.	WKEX	1430
Blackshear, Ga.	WBSG	1350
Blackstone, Va.	WKLV	1440
Blackwell, Okla.	KLOR	1580
Blaine, Wash.	KARI	550
Blakely, Ga.	WBBK	1260
Blanding, Utah	KUTA	790
Bloomington, Ill.	WJBC	1230
Bloomington, Ind.	WTTS	1370
Bloomsburg, Pa.	WCNR	930
	WHLM	550
Blountstown, Fla.	WKMK	1000
Blue Earth, Minn.	KBEW	1560
Bluefield, W.Va.	WHIS	1440
	WKOY	1240
Blythe, Calif.	KYOB	1450
Blytheville, Ark.	KLCN	910
Boaz, Ala.	WBSA	1300
Boca Raton, Fla.	WSBR	740
Bogalusa, La.	WIKC	1490
	WBOX	920
Boise, Ida.	KATN	950
	KBOI	670
	KEST	790
	KGEM	1140
	KIDO	630
	KYME	740
Bolivar, Mo.	KBLR	1130
Bolivar, Tenn.	WBOL	1560
Bonham, Tex.	KFYN	1420
	KWBG	1590
Boone, N.C.	WATA	1450
Boonville, Ind.	WBNL	1540
Booneville, Miss.	WBIP	1400
Boonville, Mo.	KWRT	1370
Boonville, N.Y.	WBRV	900
Borger, Tex.	KHUZ	1490
	KBBB	1600
Boston, Mass.	WBZ	1030
	WCOP	1150
	WILD	1090
	WEZE	1260
	WEEI	590
	WHDH	850
	WMEX	1510
	WRKO	680
	WRYT	950
Boulder, Colo.	KBOL	1490
Bowie, Tex.	KBAN	1410
Bowling, Green, Ky.	WKCT	930
	WBGN	1340
	WLBJ	1410
Bowling Green, Mo.	KPCR	1530
Bowl. Green, Ohio	WMGS	730
Bozeman, Mont.	KXL	1450
	KBMN	1230
Bradbury Hgts., Md.	WPGC	1580
Braddock, Pa.	WLOA	1550
Braddocks Heights, Md.	WMHI	1370
Bradenton, Fla.	WTRL	1490
	WBRD	1420
Bradford, Pa.	WESB	1490
Brady, Tex.	KNEL	1490
Brainerd, Minn.	KLIZ	1380
	KVBR	1340
Brandon, Miss.	WRKN	970
Branson, Mo.	KBHM	1220
Brantford, Ont.	CKPC	1380
Brattleboro, Vt.	WTSA	1450
	WKVT	1490
Brawley, Calif.	KROP	1300
Brazil, Ind.	WWCM	1380
Breckenridge, Minn. Wahpeton, N.D.	KBMW	1450
Breckenridge, Tex.	KSTB	1430
Bremen, Ga.	WWCC	1440
Bremerton, Wash.	KBRO	1490
Brenham, Tex.	KWHI	1280
Brevard, N.C.	WPNF	1240
Brewster, N.Y.	WPUT	1510
Brewton, Ala.	WEBJ	1240
Bridgeport, Ala.	WBTS	1480
Bridgeport, Conn.	WICC	600
	WDJZ	1530
	WNAB	1450
Bridgetown, N.J.	WSNJ	1240
Brigham City, Utah	KBUH	800
Brighton, Colo.	KBRN	800
Brinkley, Ark.	KBRI	1570
Bristol, Conn.	WBIS	1440
Bristol, Tenn.	WOPI	1490
	WKYE	1550
Bristol, Va.	WCYB	690
	WFHG	980
Brockport, N.Y.	WADD	1560
Brockton, Mass.	WBET	1460
	WOKW	1410
Brockville, Ont.	CFJR	1450
Broken Bow, Nebr.	KCNI	1280
Bronson, Mo.	KBHM	1220
Brookfield, Conn.	WINE	940
Brookfield, Mo.	KGHM	1470
Brookhaven, Miss.	WJMB	1340
Brookings, Oreg.	KURY	910
Brookings, S.Dak.	KBRK	1430
Brookline, Mass.	WUNR	1600
Brookneal, Va.	WODI	1230
Brooksville, Fla.	WWJB	1450
Brownfield, Tex.	KKUB	1300
Brownsville, Pa.	WASP	1130
Brownsville, Tenn.	WBHT	1520
Brownsville, Tex.	KBOR	1600
Brownwood, Tex.	KBWD	1380
	KEAN	1240
Brunswick, Ga.	WGIG	1440
	WMOG	1490
	WYNR	790
Brunswick, Maine	WCME	900
Brunswick, Md.	WTRI	1520
Bryan, Ohio	WBNO	1520
Bryan, Tex.	KORA	1240
Bryson City, N.C.	WBHN	1590
Buckhannon, W.Va.	WBUC	1460
Bucyrus, Ohio	WBCO	1540
Buffalo, N.Y.	WBEN	930
	WYSL	1400
	WEBR	970
	WGR	550
	WKBW	1520
	WWOL	1120
Buffalo, Wyo.	KBBS	1450
Buford, Ga.	WDYZ	1460
Burbank, Cal.	KBBQ	1500
Burgaw, N.C.	WPGF	1470
Burien, Wash.	KJWE	800
Burley, Idaho	KBAR	1230
Burlington, Colo.	KNAB	1140
Burlington, Iowa	KBUR	1490
	KYND	1150
Burlington, N.C.	WBBB	920
	WBAG	1150
Burlington-Graham, N.C.	WBBB	920
Burlington, Vt.	WDOT	1400
	WJOY	1230
	WVMT	620
Burnett, Tex.	KTSL	1340
Burnettown, S.C.	WVAP	1510
Burney, Cal.	KAVA	1450
Burns, Oreg.	KRNS	1230
Burnsville, N.C.	WKYK	1540
Butler, Ala.	WPRN	1240
Butler, Mo.	KMAM	1530
Butler, Pa.	WBUT	1050
	WISR	680
Butte, Mont.	KBOW	550
	KXLF	1370
Cabo Rojo, P.R.	WEKO	930
Cadillac, Mich.	WATT	1240
	WWAM	1370
Cadiz, Ky.	WKDZ	1110
Caguas, P.R.	WNEL	1430
	WVJP	1110
Cairo, Ga.	WGRA	790
Cairo, Ill.	WKRO	1490
Calais, Maine	WQDY	1230
Caldwell, Idaho	KCID	1490
	KBGN	910
Calera, Ala.	WBYE	1370
Calexico, Calif.	KICO	1490
Calhoun, Ga.	WEBS	1110
Calhoun City, Miss.	WURL	1530
Camas, Wash.	KVAN	1480
Cambridge, Md.	WCEM	1240
Cambridge, Mass.	WCAS	740
Cambridge, Ohio	WILE	1270
Camden, Ala.	WCOX	1540
Camden, Ark.	KAMD	910
	KJWH	1450
Camden, N.J.	WCAM	1310
	WTMR	800
Camden, S.C.	WACA	1590
Camden, Tenn.	WFWL	1220
Cameron, Tex.	KMIL	1330
Camilla, Ga.	WCLB	1220
Campbell, Ohio	WHOT	1330
Campbellsville, Ky.	WTCO	1450
Camuy, P.R.	WCHQ	1360
Canadaigua, N.Y.	WCGR	1550
Cannon City, Colo.	KRLN	1400
Canonsburg, Pa.	WARD	540
Canton, Ga.	WCHK	1290
Canton, Ill.	WBYS	1580
Canton, Miss.	WMGO	1370
Canton, N.C.	WWIT	970
	WPTL	920
Canton, O.	WHBC	1480
	WOIO	1060
	WINW	1520
	WNYN	900
Canyon, Tex.	KCAN	1550
Cape Girardeau, Mo.	KFVS	960
	KZYM	1220
	KGMO	1550
Carbondale, Ill.	WCIL	1020
Carbondale, Pa.	WCDL	1440
Caribou, Maine	WFST	600
Carlisle, Pa.	WHYL	960
	WIOO	1000
Carisbad, N.Mex.	KAVE	1240
	KBAD	740
	KCCC	930
Carmel, Calif.	KRML	1410
Carmi, Ill.	WROY	1460
Carnegie, Pa.	WZUM	1590
Caro, Mich.	WKYO	1360
Carolina, P.R.	WVOZ	1400
Carrington, N.Dak.	KDAK	1600
Carrizo Springs, Tex.	KBEN	1450
Carroll, Iowa	KCIM	1380
Carrollton, Ala.	WRAG	590
Carrollton, Ga.	WLBB	1100
Carrollton, Mo.	KAOL	1430
Carson City, Nev.	KRWL	1300
Cartersville, Ga.	WBHF	1450
	WKRW	1270
Carthage, Ill.	WCAZ	990
Carthage, Mo.	KDMO	1490
Carthage, Miss.	WECP	1480
Carthage, Tenn.	WRKM	1350
Carthage, Tex.	KGAS	1590
Caruthersville, Mo.	KCRV	1370
Casa Grande, Ariz.	KPIN	1260
Casey, Ill.	WKZI	800
Casper, Wyo.	KTWO	1030
	KATI	1400
Cathedral City, Calif.	KWXY	1340
Catskill, N.Y.	WCKL	560
Cayce, S.C.	WCAY	620
Cayey, P.R.	WLEY	1080
Cedar City, Utah	KSUB	590
Cedar Falls, Iowa	KCFI	1250
Cedar Rapids, Iowa	KCRG	1600
	KLWW	1450
	WMT	600
	KHAK	1360
Cedartown, Ga.	WGAA	1340
Celina, Ohio	WCSM	1350
Center, Tex.	KDET	930
Centerville, Ala.	WBIB	1590
Centerville, Iowa	KCOG	1400
Centerville, Ind.	WHON	930
Centreville, Miss.	WLBS	1580
Centerville, Tenn.	WHLP	1570
Centerville, Utah	KBBC	1600
Central City, Ky.	WNES	1050
	WMTA	1380
Centralia, Ill.	WILY	1210
Centralia & Chehalis, Wash.	KELA	1470
Central Point, Ore.	KPTK	1400
Centre, Ala.	WAGC	1580
	WEIS	990
Centreville, Ala.	WBIB	1110
Ceres, Calif.	KLOC	920
Chadburn, N.C.	WVOE	1590
Chadron, Nebr.	KCSR	610
Chambersburg, Pa.	WCHA	800
	WCBG	1590
Chanute, Kan.	KKOY	1460
Chapel Hill, N.C.	WCHL	1360
Chardon, O.	WBKC	1560
Charleroi, Pa.	WESA	940
Charles City, Iowa	KCHA	1580
Charleston, Ill.	WEIC	1270
Charleston, Mo.	KCHR	1350
Charleston, S.C.	WCSC	1390
	WOKE	1340
	WPAL	730
	WQSN	1450
	WTMA	1250
Charleston, W.Va.	WCAW	680
	WCHS	580
	WXIT	1490
	WKAZ	950
	WTIP	1240
	WXVA	1550
Charlotte, Mich.	WCER	1390
Charlotte, N.C.	WBT	1110
	WAYS	610
	WGIV	1600
	WKTC	1310
	WSOC	930
	WIST	1240
	WAME	1480
	WRPL	1540
Charlotte Amalie, V.I.	WBNB	1000
	WSTA	1340
	WBNB	1000
Charlottesville, Va.	WCHV	1260
	WELK	1010
	WINA	1070
Chase City, Va.	WMEK	980
Chatham, Va.	WKBY	1080
Chattahoochee, Fla.	WSBP	1580
Chattanooga, Tenn.	WMOC	1450
	WDEF	1370
	WDOD	1310
	WDYB	1490
	WGOW	1150
	WNOO	1260
Cheboygan, Mich.	WCBY	1240
Cheektowaga, N.Y.	WNIA	1230
Chehalis-Centralia, Wash.	KITI	1420
Chelan, Wash.	KOZI	1230
Cheraw, S.C.	WCRE	1420
Cherryville, N.C.	WCSL	1590
Cherokee, Iowa	KCHE	1440
Chesapeake, Va.	WCPK	1600
Chester, Ill.	KSGM	980
Chester, Pa.	WEEZ	1590
	WVCH	740
Chester, S.C.	WGCD	1490
Chester, Va.	WIKI	1410
Chestertown, Md.	WCTR	1530
Cheyenne, Wyo.	KFBC	1240
	KCGO	1590
	KRAE	1480
	KVWO	1370
Chicago, Ill.	WAIT	820
	WBBM	780
	WCFL	1000
	WEDC	1240
	WGN	720
	WGRP	950
	WIND	560
	WJJD	1160
	WLS	890
	WMAQ	670
	WMBI	1110
	WNUS	1390
	WSBC	1240
Chicago Hgts., Ill.	WMPP	1470
	WCGO	1600
Chickasha, Okla.	KWCO	1560
Chico, Calif.	KHSL	1290
	KPAY	1060
Chicopee, Mass.	WACE	730
Chiefland, Fla.	WLQH	940
Childress, Tex.	KCTX	1510
Chillicothe, Mo.	KCHI	1010
Chillicothe, Ohio	WBEX	1490
	WCHI	1350
Chipley, Fla.	WBGC	1240
Chippewa Falls, Wis.	WAXX	1150
Christiansburg, Va.	WJJJ	1260
Christiansted, V.I.	WSTX	970
Church Hill, Tenn.	WMCH	1260
Cicero, Ill.	WVON	1450
Cincinnati, Ohio	WCKY	1530
	WCIN	1480
	WKRC	550
	WLW	700
	WSAI	1360
	WUBE	1230
	WZIP	1050
Clanton, Ala.	WKLF	980
Clare, Mich.	WCRM	990
Claremont, N.H.	WTSV	1230
Claremore, Okla.	KWPR	1270
Clairon, Pa.	WWCH	1300
Clarksburg, W. Va.	WBOY	1400
	WHAR	1340
	WPDX	750
Clarksdale, Miss.	WROX	1450
	WKDL	1600
Clarksville, Ark.	KLYR	1360
Clarksville, Tenn.	WJZM	1400
	WDXN	540
Clarksville, Tex.	KCAR	1350
Claxton, Ga.	WCLA	1470
Clayton, Ga.	WGHC	1570
Clayton, Mo.	KXLW	1320
	KFUO	850
Clayton, N.Mex.	KLMX	1450
Clearfield, Pa.	WCPA	900
Clearwater, Fla.	WTAN	1340
	WAZE	860
Cleburne, Tex.	KCLE	1120
Clemson, S.C.	WCCP	1560
Cleveland, Ga.	WRWH	1350
Cleveland, Miss.	WCLD	1490
	WDSK	1410
Cleveland, Ohio	WKYC	1100
	WIXY	1260
	WERE	1300
	WGAR	1220
	WHK	1420
	WABQ	1540
	WJW	850
Cleveland, Tenn.	WBAC	1340
	WCLE	1570
Cleveland, Tex.	KVLB	1410
Cleve. Hghts., Ohio	WJMO	1490
Clewiston, Fla.	WOWY	1590
Clifton, Ariz.	KCLF	1400
	KCUZ	1490
Clifton Forge, Va.	WCFV	1230
Clincho, Va.	WDIC	1430
Clinton, Ill.	WHOW	1520
Clinton, Iowa	KCLN	1390
	KROS	1340
Clinton, Mo.	KDKD	1280
Clinton, N.C.	WRRZ	800
Clinton, Okla.	KWOE	1320
Clinton, S.C.	WPCC	1410
Clinton, Tenn.	WYSH	1380
Cloquet, Minn.	WKLK	1230
Clovis, N.Mex.	KCLV	1240
	KICA	980
Coachella, Calif.	KCHV	970
Coalinga, Cal.	KOLI	1470
Coamo, P.R.	WCPR	1450
Coatesville, Pa.	WCOJ	1420

WHITE'S RADIO LOG

Location	C.L.	kHz
Cochran, Ga.	WVMG	1440
Cocoa, Fla.	WKKO	860
	WEZY	1350
	WWBC	1510
Cocoa Beach, Fla.	WRKT	1300
Cody, Wyo.	KODI	1400
Coeur d'Alene, Ida.	KVNI	1240
Coffeyville, Kans.	KGGF	690
Colby, Kans.	KXXX	790
Coldwater, Mich.	WTVB	1590
Coleman, Tex.	KSTA	1000
Colfax, Wash.	KCLX	1450
College Park, Ga.	WSSA	1570
College Station, Tex.		
	WTAW	1150
Collierville, Tenn.	WPIP	1590
Collinsville, Va.	WFIC	1530
Colonial Heights, Va.		
	WPVA	1290
Colorado City, Tex.	KVMC	1320
Colo. Sprgs., Colo.	KRDO	1240
	KPIK	1580
	KVOR	1300
	K8SS	740
	KYSN	1460
	KRYT	1530
Columbia, Ky.	WAIN	1270
Columbia, La.	KCTO	1540
Columbia, Miss.	WCJU	1450
	WFFF	1360
Columbia, Mo.	KFRU	1400
	KTGR	1580
Columbia, Pa.	WCOY	1580
Columbia, S.C.	WCOS	1400
	WIS	560
	WOIC	1320
	WNOK	1230
	WQXL	1470
Columbia, Tenn.	WMCP	1280
	WKRM	1340
Columbus Ga.	WDAK	540
	WRBL	1420
	WHYD	1270
	WCLS	1580
	WOKS	1340
	WPNX	1460
Columbus, Ind.	WCSI	1010
Columbus, Miss.	WACR	1050
	WCBI	550
Columbus, Nebr.	KJSK	900
	KTTT	1510
Columbus, Ohio	WBNS	1460
	WCOL	1230
	WMNI	920
	WOSU	820
	WTVN	610
	WVKO	1580
Colville, Wash.	KCVL	1270
Comanche, Tex.	KCOM	1550
Commerce, Ga.	WJJC	1270
Concord, Calif.	KWUN	1480
Concord, N.H.	WKXL	1450
Concord, N.C.	WEGO	1410
Concordia, Kans.	KNCK	1390
Conneaut, Ohio	WWOW	1360
Connellsville, Pa.	WCVI	1340
Connersville, Ind.	WCNB	1580
Conroe, Tex.	KMCO	900
Conway, Ark.	KCON	1230
	KVEE	1330
Conway, N.H.	WBNC	1050
Conway, S.C.	WLAT	1330
Cookeville, Tenn.	WHUB	1400
	WPTN	1550
Coolidge, Ariz.	KCKY	1150
Coos Bay, Oreg.	KOOS	1230
	KYNG	1420
Copper Hill, Tenn.	WLSB	1400
Coquille, Oreg.	KWRO	630
Coral Gables, Fla.	WRIZ	1550
	WVCG	1080
Corbin, Ky.	WCTT	680
	WYGO	1330
Cordele, Ga.	WMJM	1490
Cordova, Alaska	KLAM	1450
Corinth, Miss.	WCMA	1230
	WKCU	1350
Cornelia, Ga.	WCON	1450
Corning, Ark.	KCCB	1260
Corning, N.Y.	WCBA	1350
	WCLI	1450
Cornwall, N.Y.	WWLE	1170
Corona, Cal.	KREL	1370
Corpus Christi, Tex.		
	KCTA	1030
	KCCT	1150
	KEYS	1440
	KRYS	1360
	KSIX	1230
	KUNO	1400
Corry, Pa.	WOTR	1370
Corsicana, Tex.	KAND	1340
Cortez, Colo.	KVFC	740
Cortland, N.Y.	WKRT	920
Corvallis, Ore.	KLOO	1340
	KFLY	1240
	KOAC	550
Corydon, Ind.	WPDF	1550
Coshocton, Ohio	WTNS	1560
Cottage Grove, Ore.	KNND	1400
Cottonwood, Ariz.	KVRD	1240
	KVIO	1600
Coudersport, Pa.	WFRM	600
Council Bluffs, Iowa		
	KRCB	1560
Courtenay, B.C.	CFCP	1440
Covington, Ga.	WGFS	1430
Covington, Ky.	WCLU	1320
Covington, La.	WARB	730
Covington, Tenn.	WKBL	1250
Covington, Va.	WKEY	1340
Cowan, Tenn.	WZYX	1440
Cozad, Neb.	KAMI	1580
Craig, Colo.	KRAI	550
Crane, Tex.	KCRR	1380
	KBSN	970
Crawfordsville, Ind.		
	WCVL	1550
Crescent City, Calif.	KPLY	1240
	KPOD	1310
Creston, Iowa	KSIB	1520
Crestview, Fla.	WCNU	1010
	WJSB	1050
Crewe, Va.	WSVS	800
Crockett, Tex.	KIVY	1290
Crookston, Minn.	KROX	1260
Crossett, Ark.	KAGH	800
Crossville, Tenn.	WAEW	1330
	WCSV	1520
Crowley, La.	KSIG	1450
Crozet, Va.	WPED	810
Crystal Lake, Ill.	WIVS	850
Cuero, Tex.	KCFH	1600
Cullman, Ala.	WFMH	1480
	WKUL	1340
Culpeper, Va.	WCVA	1490
Cumberland, Ky.	WCPM	1280
Cumberland, Md.	WCUM	1230
	WUOK	1270
	WTBO	1450
Cummings, Ga.	WSNE	1410
Cushing, Okla.	KUSH	1660
Cuyahoga Falls, Ohio		
	WCUE	1150
Cypress Gardens, Fla.		
	WGTO	540
Cynthiana, Ky.	WCYN	1400
Dade City, Fla.	WDCF	1350
Dadeville, Ala.	WDVC	910
Daingerfield, Tex.	KEGG	1560
Dalhart, Tex.	KXIT	1410
Dallas, N.C.	WAAK	960
Dallas, Oreg.	KROW	1460
Dallas, Tex.	KRLD	1080
	KIXL	1040
	KSKY	660
	KLIF	1190
	WFAA	570
	WFAA	820
	KBOX	1480
	WRR	1310
Dalton, Ga.	WBLJ	1230
	WRCD	1480
	WTTI	1530
Danbury, Conn.	WLAD	800
Danville, Ill.	WDAN	1490
	WITY	980
Danville, Ky.	WHIR	1230
Danville, Pa.	WPGM	1570
Danville, Va.	WBTM	1330
	WYPR	970
	WDVA	1250
	WILA	1580
Dardanelle, Ark.	KCAB	980
Darlington, S.C.	WDAB	1350
Davenport, Iowa	WOC	1420
	KWNT	1580
	KSTT	1170
Dawson, Ga.	WDWD	990
Dayton, Ohio	WHIO	1290
	WING	1410
	WONE	980
	WAVI	1210
Dayton, Tenn.	WDNT	1280
Daytona Beach, Fla.		
	WNDB	1150
	WMFJ	1450
	WBOD	1340
Deadwood, S.Dak.	KDSJ	980
Dearborn, Mich.	WKNR	1310
Decatur, Ala.	WHOS	800
	WAJF	1490
	WMSL	1400
Decatur-Atlanta, Ga.		
	KGUN	1010
	WOMN	1310
Decatur, Ill.	WDZ	1050
	WSOY	1340
Decatur, Ind.	WADM	1540
	KWLC	1240
Deer Lodge, Mont.	KDRG	1400
Deerfield, Va.	WABH	1150
Defiance, Ohio	WONW	1280
De Funiak Springs, Fla.		
	WGTX	1280
	WZEP	1460
De Kalb, Ill.	WLBK	1360
De Land, Fla.	WJBS	1490
	WOOO	1310
Delano, Calif.	KCHJ	1010
Delaware, Ohio	WDLE	1550
Delray, Bch., Fla.	WDBF	1420
Del Rio, Tex.	KDLK	1230
	KWDR	810
	KWMC	1490
Delta, Colo.	KDTA	1400
Deming, N.M.	KDOT	1230
Demopolis, Ala.	WXAL	1400
Denham Sprgs., La.	WLBI	1220
Denison, La.	KDSN	1530
Denison-Sherman, Tex.		
	KDSX	950
Denmark-Bamberg, S.C.		
	WWBD	790
Denton, Tex.	KDNT	1440
Denver, Colo.	KDEN	1340
	KFML	1390
	KHOW	630
	KIMN	950
	KLIR	990
	KLZ	560
	KBTR	710
	KOA	850
	KFSC	1220
Denver City, Tex.	KTLK	1280
De Queen, Ark.	KDQN	1390
DeRidder, La.	KDLA	1010
DeSoto, Mo.	KHAD	1190
Des Moines, Iowa	KCBC	1390
	KIOA	940
	KRNT	1350
	K8O	1460
	KWKY	1150
Detroit, Mich.	WHO	1040
	WCAR	1130
	WDEE	1500
	WJLB	1400
	WJR	760
	WWJ	950
	WXYZ	1270
Detroit Lakes, Minn.		
	KDLM	1340
Devils Lake, N.Dak.		
	KDLR	1240
DeWitt, Ark.	KDEW	1470
Dexter, Mo.	KDEX	1590
Diboll, Tex.	KSPL	1260
Dickinson, N.Dak.	KDIX	1230
Dickson, Tenn.	WDKN	1260
Dillon, Mont.	KDBM	1490
Dillon, S.C.	WDSC	800
Dimmitt, Tex.	KDHN	1470
Dinuba, Calif.	KRDU	1130
Dixon, Ill.	WIXN	1460
Dodge City, Kans.	KGNO	1370
	KEDD	1550
Dodgeville, Wis.	WDMP	810
Donalsonville, Ga.	WSEM	1500
Donalsonville, La.	WDLV	1090
Donaldsonville, La.	WSLG	1090
Donelson, Tenn.	WAMB	1190
Doniphans, Mo.	KDFN	1500
Dothan, Ala.	WAGF	1320
	WDIG	1450
	WOOF	560
Douglas, Ariz.	KAWT	1450
	KAPR	950
Douglas, Ga.	WDMG	860
	WOKA	1310
Douglas, Wyo.	KWIV	1050
Douglasville, Ga.	WDGL	1520
Dover, Del.	WDOV	1410
	WKEN	1590
Dover-Foxcraft, Me.		
	WDME	1340
Dover, N.H.	WTSN	1270
Dover, N.J.	WRAN	1510
Dover-New Philadelphia, O.		
	WJER	1450
Dowagiac, Mich.	WDOW	1440
Doylestown, Pa.	WBUX	1570
Dublin, Ga.	WMLT	1330
	WXLT	1230
Du Bois, Pa.	WCED	1420
Dubuque, Iowa	KDTH	1370
	WDBQ	1600
Duluth, Minn.	KDAL	610
	WEBC	560
	KAOH	1890
Dumas, Ark.	KDDA	1560
Dumas, Tex.	KDDD	800
Duncan, Okla.	KRHD	1350
Dunedin, Fla.	WCWR	1470
Dundee, N.Y.	WFLR	1570
Dunkirk, N.Y.	WDOE	1410
Dunn, N.C.	WCKB	780
Du Quoin, Ill.	WDQN	1580
Durand, Wis.	WRDN	1430
Durango, Colo.	KIUP	930
	KDGO	1240
Durant, Okla.	KSFO	750
Durham, N.C.	WDNC	620
	WSRC	1410
	WSSB	1490
	WTIK	1310
Dyersburg, Tenn.	WDSG	1450
	WTRO	1330
Eagle Pass, Tex.	KEPS	1270
Eagle River, Wis.	WERL	950
Easley, S.C.	WELP	1360
E. Grand Forks, Minn.		
	KRAD	1590
Eastland, Tex.	KERC	1590
E. Lansing, Mich.	WKAR	870
	WVIC	730
E. Liverpool, Ohio	WHHI	1490
East Longmeadow, Mass.		
	WTYM	1600
Eastman, Ga.	WUFF	710
E. Moline, Il.	WDLM	960
E. Point, Ga.	WTJH	1260
East Prairie, Mo.	KYMO	1080
E. Syracuse, N.Y.	WPAW	1540
Easton, Md.	WEMO	1460
Easton, Pa.	WEEX	1230
	WEST	1400
Eatonton, Ga.	WXPQ	1520
Eatontown, N.J.	WHTG	1410
Eau Claire, Wis.	WEAQ	790
	WBIZ	1400
	WOKL	1050
Eau Gallie, Fla.	WMEG	920
	WTAI	1560
Ebensburg, Pa.	WEND	1580
Edenton, N.C.	WCDJ	1260
Edinburg, Tex.	KURV	710
Edmonds, Wash.	KGDN	630
Edna, Tex.	KWBY	1130
Effingham, Ill.	WCRA	1090
Elba, Ala.	WELB	1350
Elberton, Ga.	WSGC	1400
El Cajon, Calif.	KOEO	910
El Campo, Tex.	KULP	1390
El Centro, Calif.	KXO	1230
	KAMP	1430
El Dorado, Ark.	KDMS	1290
	KELD	1400
Eldorado, Kans.	KBTO	1380
Eldorado Springs, Mo.		
	KESM	1580
Eleele, Kanai, Hawaii		
	KUAI	720
Elgin, Ill.	WRMN	1410
Elizabeth, N.J.	WELA	1530
Elizabeth City, N. C.		
	WCNC	1240
	WGAI	560
Elizabethton, Tenn.	WBEJ	1240
	WIDD	1520
Elizabethtown, Ky.	WIEL	1400
Elizabethtown, N.C.		
	WBLA	1440
Elizabethtown, Pa.	WEPN	1600
Elk City, Okla.	KBEK	1240
	WCMR	1270
Elkins, N.C.	WIFM	1540
Elkins, W.Va.	WDNE	1240
Elko, Nev.	KELK	1240
Elkton, Md.	WSER	1550
Ellensburg, Wash.	KXLE	1240
Ellenville, N.Y.	WELV	1350
Ellsworth, Me.	WDEA	1370
Elmira, N.Y.	WELM	1410
	WENY	1230
Elmira Heights-Horseheads, N.Y.		
	WEHH	1590
El Paso, Tex.	KROD	600
	KELP	920
	KHEY	690
	KINT	1590
	KIZZ	1150
	KSET	1340
	KTSM	1380
El Reno, Okla.	KELR	1460
Ely, Minn.	WELY	1450
Ely, Nev.	KELY	1230
Elyria, Ohio	WEOL	930
Eminence, Ky.	WSTL	1600
Emporia, Kans.	KVOE	1400
Emporia, Va.	WEVA	860
Emporium, Pa.	WLEM	1250
Endicott, N.Y.	WENE	1430
Englewood, Colo.	KGMC	1150
Englewood, Fla.	WENG	1530
Englewood, Tenn.	WENR	1090
Enid, Okla.	KCRC	1390
	KGWA	960
Enterprise, Ala.	WIRB	600
Enterprise, Oreg.	KWVR	1340
Ephrata, Pa.	WGSA	1310
Ephrata, Wash.	KULF	730
Erie, Pa.	WWYN	1260
	WJET	1400
	WRIE	1330
	WWGO	1450
Erwin, Tenn.	WEMB	1420
Escanaba, Mich.	WDBC	680
	WLST	600
Escondido, Calif.	KOWN	1450
Espanola, N. M.	KDCE	970
Estes Park, Colo.	KKEP	1470
Estherville, Ia.	KILR	1070
Etowah, Tenn.	WCPH	1220
Eufaula, Ala.	WULA	1240
Eugene, Ore.	KEED	1450
	KASH	1600
	KATR	1320
	KORE	1050
	KERG	1280
	KPNW	1120

Location	C.L.	kHz
	KUGN	590
	KZEL	1540
Eunice, La.	KEUN	1490
Eureka, Calif.	KINS	980
	KRED	1480
Eustis, Fla.	WLCO	1240
Evanston, Ill.	WEAW	1330
	WNMP	1590
Evanston, Wyo.	KEVA	1240
Evansville, Ind.	WROZ	1400
	WGBF	1280
	WIKY	820
	WJPS	1330
Eveleth, Minn.	WEVE	1340
Everett, Pa.	WSKE	1050
Everett, Wash.	KRKO	1380
	KWYZ	1230
Evergreen, Ala.	WBLO	1470
Excelsior Springs, Mo.		
	KEXS	1090
Exeter, N.H.	WKXR	1540
Fairbanks, Alaska	KFAR	660
	KFRB	900
Fairbault, Minn.	KDHL	920
Fair Bluff, N.C.	WWKO	1480
Fairbury, Nebr.	KGMT	1310
Fairfax, Va.	WEEL	1310
Fairfield, Ill.	WFIW	1390
Fairfield, Iowa	KMCO	1570
Fairfield, O.	WCNW	1560
Fairhope, Ala.	WABF	1220
Fairmont, Minn.	KSUM	1370
Fairmont, N.C.	WFMO	860
Fairmont, W.Va.	WMMN	920
	WTCS	1490
Fairway, Kan.	KUDL	1380
Fajardo, P.R.	WMDD	1480
Falfurrias, Tex.	KPSO	1260
Fallon, Nev.	KVLV	980
Fall River, Mass.	WALE	1400
	WSAR	1480
Falls Church, Va.	WFAX	1220
Falls City, Nebr.	KTNC	1230
Fargo, N.Dak.	WDAY	970
	KFGO	790
	KFNW	900
	KQWB	1550
Faribault, Minn.	KDHL	920
Farmersville, La.	KTDL	1470
Farmington, Me.	WKTJ	1380
Farmington, Mo.	KREI	800
Farmington, N.M.	KENN	1390
	KWYK	960
	KRZE	1280
Farmville, N.C.	WFAG	1250
Farmville, Va.	WFLO	870
Farrell, Pa.	WFAR	1470
Farwell, Tex.	KZOL	1570
Fayette, Ala.	WWWF	990
Fayetteville, Ark.	KHOG	1440
	KFAY	1250
Fayetteville, N.C.	WFAI	1230
	WFNC	940
	WFLB	1490
	WIDU	1600
Fayetteville, Tenn.	WEKR	1240
Fergus Falls, Minn.	KBRF	1250
Fernandina Beach, Fla.	WFBF	1570
Ferriday, La.	KFNV	1600
Festus, Mo.	KJCF	1400
Festus-St. Louis, Mo.	KXEN	1010
Findlay, Ohio	WFIN	1330
Fisher, W.Va.	WELD	690
Fitchburg, Mass.	WEIM	1280
	WFGL	960
Fitzgerald, Ga.	WBHB	1240
Flagstaff, Ariz.	KCLS	600
	KAFF	930
	KEOS	690
Flat River, Mo.	KFMO	1240
Flint, Mich.	WFDF	910
	WTRX	1330
	WAMM	1420
	WMRP	1570
	WKMF	1470
	WTAC	600
Flematon, Ala.	WTCB	990
Florence, Ala.	WJOI	1340
	WOWL	1240
Florence, S.C.	WJMX	970
	WOLS	1230
	WYNN	540
Floydada, Tex.	KFLD	900
Foley, Ala.	WHEP	1310
Fond du Lac, Wis.	KFIZ	1450
Fordyce, Ark.	KBJT	1570
Forest, Miss.	WMAG	860
Forest City, N.C.	WBBO	780
	WAGY	1320
Forks, Wash.	KVAC	1490
Forrest City, Ark.	KXJK	950
Ft. Atkinson, Wis.	WFAW	940
Ft. Bragg, Calif.	KDAC	1230
Ft. Campbell, Ky.	WABD	1370
Ft. Collins, Colo.	KCOL	1410
	KEWE	600
Ft. Dodge, Iowa	KVFD	1400
	KWMT	540
Ft. Knox, Ky.	WSAC	1470
Ft. Lauderdale, Fla.	WFTL	1400
	WSRF	1580
	WAVS	1190
Ft. Madison, Iowa	KXGI	1360
Ft. Morgan, Colo.	KFTM	1400
Ft. Myers, Fla.	WINK	1240
	WMYR	1410
	WCAI	1350
Ft. Payne, Ala.	WFPA	1400
	WZOB	1250
Ft. Pierce, Fla.	WARN	1330
	WIRA	1400
Ft. Scott, Kans.	KMDO	1600
Ft. Smith, Ark.	KFPW	1230
	KFSA	950
	KTCS	1410
	KWHN	1320
Ft. Stockton, Tex.	KFST	860
Ft. Valley, Ga.	WFPM	1150
Ft. Walton Beach, Fla.	WNUE	1400
	WFTW	1260
Ft. Wayne, Ind.	WGL	1250
	WFWR	1090
	WOWO	1190
	WLYV	1450
	WKJG	1380
Ft. Worth, Tex.	KJIM	870
	KBUY	1540
	KFJZ	1270
	KNOK	970
	WBAP	570
	WBAP	820
	KXOL	1360
Fortuna, Cal.	KNCR	1090
Fosston, Minn.	KEHG	1480
Fostoria, Ohio	WFOB	1430
Fountain Inn, S.C.	WFIS	1600
Fowler, Calif.	KLIP	1220
Framingham, Mass.	WKOX	1190
Frankfort, Ind.	WILO	1570
Frankfort, Ky.	WFKY	1490
Franklin, Ky.	WFKN	1220
Franklin, La.	KFRA	1390
	WFCG	1110
Franklin, N.C.	WFSC	1050
Franklin, N.H.	WFTN	1240
Franklin, Pa.	WFRA	1450
Franklin, Tenn.	WAGG	950
	WIZO	1380
Franklin, Va.	WYSR	1250
Franklinton, La.	WFCG	1110
Frederick, Md.	WFMD	930
Frederick, Okla.	KTAT	1570
Fredericksburg, Tex.	KNAF	910
Fredericksburg, Va.	WFVA	1230
	WFLS	1350
Fredericktown, Mo.	KFTW	1450
Fredonia, N.Y.	WBUZ	1570
Freeport, N.Y.	WGBB	1240
Freeport, Tex.	KBRZ	1460
Freemont, Mich.	WSHN	1550
Fremont, Nebr.	KHUB	1340
Fremont, Ohio	WFRO	980
Fresno, Calif.	KARM	1430
	KBIF	900
	KIRV	1510
	KEAP	980
	KXEX	1550
	KFRE	940
	KGST	1600
	KMAK	1340
	KMJ	580
	KYNO	1300
Friona, Tex.	KNNN	1070
Front Royal, Va.	WFTR	1450
Frostburg, Md.	WFRB	580
Fulton, Ky.	WFUL	1270
Fulton, Miss.	WFTO	1330
Fulton, Mo.	KFAL	900
Fulton, N.Y.	WOSC	1300
Fuquay-Varina, N.C.	WAKS	1460
Gadsden, Ala.	WGAD	1350
	WJBY	930
	WAAX	570
Gaffney, S.C.	WFGN	1570
	WEAC	1500
Gainesville, Fla.	WDVH	980
	WGGG	1230
	WRUF	850
	WUWU	1390
Gainesville, Ga.	WGGA	550
	WDUN	1240
	WNRJ	1580
Gainesville, Tex.	KGAF	1580
Gaithersburg, Md.	WHMC	1150
Galax, Va.	WBOB	1360
Galesburg, Ill.	WGIL	1400
	WAIK	1590
Gallatin, Tenn.	WHIN	1010
	WAMG	1130
Gallipolis, Ohio	WJEH	990
Gallup, N. Mex.	KGAK	1330
	KYVA	1230
Galveston, Tex.	KILE	1400
	KGBC	1540
Gander, Nfld.	CBG	1450
Garden City, Ga.	WMNT	1520
Garden City, Kan.	KUIL	1240
	KUPK	1050
Garden City, Mich.	WTAK	1090
Gardiner, Me.	WABK	1280
Gardner, Mass.	WGAW	1340
Garner, N.C.	WKBQ	1000
Gary, Ind.	WWCA	1270
	WLTH	1370
Gastonia, N.C.	WGAS	1450
	WLTC	1370
Gate City, Va.	WGAT	1050
Gaylord, Mich.	WATC	900
Geneseo, Ill.	WGEN	1500
Geneva, Ala.	WGEA	1150
Geneva, Ill.	WGSB	1480
Geneva, N.Y.	WGVA	1240
Georgetown, Del.	WJWL	900
Georgetown, Ky.	WAXU	1580
Georgetown, S.C.	WGTN	1400
	WINH	1470
Georgetown, Tex.	KGTN	1530
Gettysburg, Pa.	WGET	1320
Gillette, Wyo.	KIML	1270
Gilroy, Cal.	KAZA	1290
Gladewater, Tex.	KEES	1430
Glasgow, Ky.	WKAY	1490
	WCDS	1440
Glasgow, Mont.	KLTZ	1240
Glen Burnie, Md.	WISZ	1590
Glendale, Ariz.	KRUX	1360
Glendale, Calif.	KIEV	870
Glendive, Mont.	KXGN	1400
	KGLE	590
Glennallen, Alaska	KCAM	790
Glens Falls, N.Y.	WBZA	1410
	WWSC	1950
Glenville, Ga.	WKIG	1580
Glenwood Sprgs., Colo.	KGLN	980
Globe, Ariz.	KZOW	1240
Gloucester, Va.	WDOY	1420
Gloversville-Johnston, N.Y.		
Gold Beach, Oreg.	KBLY	1220
	WENT	1340
Golden Meadow, La.	KLEB	1600
Golden Valley, Minn.	KQRS	1440
	KUXL	1570
Goldsboro, N.C.	WFMC	730
	WGBR	1150
	WYNG	1300
Gonzales, Tex.	KCTI	1540
Goodland, Kans.	KLOE	730
Gordon, Ga.	WKOG	1560
Goshen, Ind.	WKAM	1460
Gouverneur, N.Y.	WIGS	1230
Grafton, N.D.	KGPC	1340
Grafton, W.Va.	WVVW	1260
Graham, N.C.	WSML	1190
Graham, Tex.	KSWA	1330
Grand Coulee, Wash.	KFOR	1380
Grand Forks, N.D.	KFJM	1370
	KLQ	1440
	KNOX	1310
Grand Haven, Mich.	WGHN	1370
Grand Island, Nebr.	KMMJ	750
	KRGI	1430
Grand Junction, Colo.	KREX	1100
	KEXO	1230
	KSTR	620
	KQIL	1340
Grand Prairie, Tex.	KKDA	730
Grand Rapids, Mich.	WAFT	1480
	WJEF	1230
	WFUR	1570
	WGRO	1410
	WLAV	1340
	WOOD	1300
Grand Rapids, Minn.	KOZY	1490
Grangeville, Idaho	KORT	1230
Granite City, Ill.	WGNU	920
Granite Falls, N. C.	WKJK	900
Grants, N.Mex.	KMIN	980
Grants Pass, Oreg.	KAGI	930
	KAJO	1270
Grayson, Ky.	WGOH	1370
Gt. Barrington, Mass.	WSBS	860
Gt. Bend, Kans.	KVGB	1590
Great Falls, Mont.	KKGF	1310
	KUDI	1450
	KMON	560
	KARR	1400
Greeley, Colo.	KFKA	1310
	KYOU	1450
Green Bay, Wis.	WBAY	1360
	WDUZ	1400
	WNFL	1440
Greeneville, Tenn.	WGRV	1340
	WSMG	1450
Greenfield, Mass.	WHAI	1240
Greensboro, N.C.	WBIG	1470
	WCOG	1320
	WEAL	1510
	WKTB	1550
	WGBG	1400
	WPET	950
Greensburg, Ind.	WTRE	1330
Greensburg, Pa.	WHJB	620
Greenville, Ala.	WGYV	1380
Greenville, Mich.	WPLB	1380
Greenville, Miss.	WJPR	1330
	WDDT	900
	WGVM	1260
Greenville, N.C.	WNCT	1070
	WOOW	1340
	WPXY	1550
Greenville, Pa.	WGRP	940
Greenville, S.C.	WESC	660
	WFBC	1330
	WHYZ	1070
	WMRB	1490
	WMUU	1260
	WQOK	1440
Greenville, Tex.	KGVL	1440
Greenwich, Conn.	WGCH	1490
Greenwood, Miss.	WABG	960
	WGRM	1240
	WLEF	1540
Greenwood, S.C.	WCRS	1540
	WGSW	1350
Greer, S.C.	WEAB	800
	WCKI	1300
Grenada, Miss.	WNAG	1400
Gresham, Oreg.	KROR	1230
Gretna, La.	KGLA	1540
Gretna, Va.	WMNA	730
Gretna, Va.	WNMA	730
Griffin, Ga.	WKEU	1450
	WHIE	1320
	WGRI	1410
Grinnell, Iowa	KGRN	1410
Groton, Conn.	WSUB	980
Grove City, Pa.	WSAJ	1340
Grundy, Va.	WNRG	940
Guayama, P.R.	WXRF	1590
Gulfport, Miss.	WROA	1390
	WGCM	1240
Gunnison, Colo.	KGUC	1490
Guntersville, Ala.	WGSV	1270
Guthrie, Okla.	KWRW	1490
Guymon, Okla.	KGYN	1210
Hackensack, N.J.	WJRZ	970
	WJFJ	1240
Hagerstown, Md.	WARK	1490
Hailey, Idaho	KSKI	1340
Haines City, Fla.	WHAN	930
Haleyville, Ala.	WJBB	1230
Halfway, Md.	WHAG	1410
Hamden, Conn.	WCDQ	1220
Hamilton, Ala.	WERH	970
Hamilton, Mont.	KYLO	980
Hamilton, Ohio	WMOH	1450
Hamilton, Tex.	KCLW	900
Hamlet, N.C.	WKIX	1250
Hammond, Ind.	WJOB	1230
Hammond, La.	WFPR	1400
Hammonton, N.J.	WNJH	1580
Hampton, S.C.	WBHC	1270
Hampton, Va.	WVEC	1490
Hancock, Mich.	WMPL	920
Hanford, Calif.	KNGS	620
Hannibal, Mo.	KHMO	1070
Hanover, N.H.	WTSL	1400
	WDCR	1340
Hanover, Pa.	WHVR	1280
Hardin, Mont.	KHDN	1230
Hardinsburg, Ky.	WHIC	1520
Harlan, Ky.	WHLN	1410
Harlingen, Tex.	KGBT	1530
Harrisburg, Ill.	WEBQ	1240
Harriman, Tenn.	WHBT	1600
Harrisburg, Pa.	WFEC	1400
	WCMB	1460
	WHP	580
	WKBO	1230
Harrison, Ark.	KHOZ	900
Harrisonburg, Va.	WHBG	1360
	WKCY	1300
	WSVA	550
Harrodsburg, Ky.	WHBN	1420
Hartford, Conn.	WORC	1360
	WCCC	1290
	WPOP	1410
	WTIC	1080
Hartford, Ky.	WLLS	1600
Hartford, Wis.	WTKM	1540
Hartselle, Ala.	WHRT	860
Hartsville, S.C.	WHSC	1450
Hartsville, Tenn.	WJKM	1090
Hartwell, Ga.	WKLY	980
Harvard, Ill.	WMCW	1600
Harvey, Ill.	WBEE	1570
Hastings, Mich.	WBCH	1220
Hastings, Minn.	KDWA	1460
Hastings, Nebr.	KHAS	1230
	KICS	1550
Hattiesburg, Miss.	WBKH	950
	WFOR	1400
	WHSY	1230
	WORV	1580
	WXXX	1310
Havelock, N.C.	WKVO	1330
Haverhill, Mass.	WHAV	1490
Havre, Mont.	KOJM	610
Havre de Grace, Md.	WASA	1330
Hawkinsville, Ga.	WCEH	610
Hays, Kans.	KAYS	1400
Haynesville, La.	KLUV	1580
Hayward, Wis.	WHSM	910
Hazard, Ky.	WKIC	1390
Hazelhurst, Ga.	WVOH	920

WHITE'S RADIO LOG

Location	C.L.	kHz
Hazelhurst, Miss.	WMDC	1220
Hazelton, Pa.	WAZL	1490
	WHZN	1300
Heber Springs, Ark.	KAWW	1370
Helena, Ark.	KFFA	1360
Helena, Mont.	KCAP	1340
	KBLL	1240
Hemet, Calif.	KHSJ	1320
Hemingway, S.C.	WKYB	1000
Hempstead, N.Y.	WHLI	1100
Henderson, Ky.	WSON	860
Henderson, Nev.	KBMI	1400
	KTOO	1280
Henderson, N.C.	WHNC	890
	WIZS	1450
Henderson, Tenn.	WHHM	1580
Henderson, Tex.	KGRI	1000
	KWRD	1470
Hendersonville, N.C.	WHKP	1450
	WHVL	1600
Henryetta, Okla.	KHEN	1590
Hereford, Tex.	KPAN	860
Herkimer, N.Y.	WALY	1420
Hermiston, Oreg.	KOHU	1570
Herndon, Va.	WHRN	1440
Herrin, Ill.	WJPF	1340
Hettinger, N.Dak.	KNDC	1490
Hibbing, Minn.	WMFG	1240
Hickory, N.C.	WHKY	1290
	WIRC	630
	WSPF	1000
Highland, Ill.	WINU	1510
Highland Park, Ill.	WEEF	1430
Highland Park, Tex.	KVIL	1150
Highland Springs, Va.	WENZ	1450
High Point, N.C.	WMFR	1230
	WNOS	1590
	WHPE	1070
Hillsboro, Ohio	WSRW	1590
Hillsboro, Oreg.	KUIK	1360
Hillsboro, Tex.	KHBU	1560
Hillsdale, Mich.	WCSR	1340
Hillsville, Va.	WHHV	1400
Hilo, Hawaii	KPUA	970
	KIPA	1110
	KHLO	850
Hindman, Ky.	WKCB	1540
Hinesville, Ga.	KGML	990
Hinton, W.Va.	WMTO	1380
Hobbs, N.Mex.	KWEW	1480
Hohenwald, Tenn.	WMLR	1540
Holbrook, Ariz.	KDJI	1270
Holdenville, Okla.	KVYL	1370
Holdredge, Nebr.	KUVR	1380
Holland, Mich.	WHTC	1450
	WJBL	1260
Hollister, Cal.	KMPG	1540
Holly Springs, Miss.		
Hollywood, Fla.	WGMA	1320
	WKRA	1110
Holyoke, Mass.	WREB	930
Homer, La.	KHAL	1320
Homestead, Fla.	WIII	1430
Homewood, Ala.	WJLD	1400
Hondo, Tex.	KRME	1460
Honolulu, Hawaii	KAIM	870
Honolulu, Hawaii	KCCN	1420
	KGMB	590
	KZOO	1210
	KHAI	1090
	KPOI	1380
	KIKI	830
	KGU	760
	KHVH	1040
	KKUA	690
	KNDI	1270
	KOHO	1170
	KORL	650
	KTRG	990
	KUMU	1500
Hood River, Oreg.	KIHR	1340
Hope, Ark.	KXAR	1490
Hopewell, Va.	WHAP	1340
Hopkinsville, Ky.	WHOP	1230
	WKOA	1480
Hoquim, Wash.	KGHO	1560
Hornell, N.Y.	WHHO	1320
	WLEA	1480
Horseheads, N.Y.	WIQT	1000
Hot Springs, Ark.	KBHS	590
	KXOW	1420
	KZNG	1340
Hot Springs, S.Dak.	KOBH	580
Houghton, Mich.	WHDF	1400
Houghton Lake, Mich.	WHGR	1290
Houlton, Maine	WHOU	1340
Houma, La.	KJIN	1490
Houston, Miss.	WCPC	940
Houston, Mo.	KBTC	1250
Houston, Tex.	KCOH	1430
	KENR	1070
	KILT	610
	KNUZ	1230
	KODA	1010
	KPRC	950
	KTHT	790
	KTRH	740
	KXYZ	1320
	KYOK	1590
Howell, Mich.	WHMI	1350
Hugo, Okla.	KIHN	1340
Hudson, N.Y.	WHUC	1230
Humacao, P.R.	WALO	1240
Humboldt, Tenn.	WIBJ	740
Huntingdon, Pa.	WHUN	1150
Huntington, Ind.	WHLT	1300
Huntington, N.Y.	WGSM	740
Huntington, W. Va.	WKEE	800
	WSAZ	930
	WWHY	1470
Huntsville, Ala.	WBHP	1230
	WEUP	1600
	WFIX	1450
	WAAY	1550
	WVOV	1000
Huntsville, Tex.	KSAM	1490
Huron, S.Dak.	KIJV	1340
Hutchinson, Kans.	KWBW	1450
	KWHK	1260
Hutchinson, Minn.	KDUZ	1260
Hyde Park, N.Y.	WHVW	950
Idabel, Okla.	KBEL	1240
Idaho Falls, Idaho	KID	590
	KTEE	1260
	KUPI	980
Immokalee, Fla.	WCOF	1490
Independence, Ia.	KOUR	1220
Independence, Kans.	KIND	1010
Independence, Mo.	KCCV	1510
Indiana, Pa.	WDAD	1450
Indianapolis, Ind.	WATI	810
	WBRI	1500
	WFBM	1260
	WGEE	1590
	WIBC	1070
	WIFE	1310
	WIRE	1430
	WXLW	950
Indianola, Iowa	KBAB	1490
Indianola, Miss.	WNLA	1380
Indian Rocks Beach, Fla.	WGNP	1520
Indio, Calif.	KREO	1400
Inglewood, Calif.	KTYM	1460
Inkster, Mich.	WCHB	1440
International Falls, Minn.	KGHS	1230
Inverness, Fla.	WYSE	1560
Iola, Kansas	KALN	1370
Iobia, Mich.	WION	1430
Iowa City, Iowa	KXIC	800
	WSUI	910
Iowa Falls, Ia.	KIFG	1510
Irondale, Ala.	WLPH	1480
Iron Mtn., Mich.	WMIQ	1450
Iron River, Mich.	WIKB	1230
Ironton, Ohio	WIRO	1230
Ironwood, Mich.	WJMS	590
Irvine, Ky.	WIRV	1550
Isabella, P.R.	WISA	1390
Ishpeming, Mich.	WJPO	1240
	WCKD	970
Islip, N.Y.	WLIX	540
Ithaca, N.Y.	WHCU	870
	WTKO	1470
Iuka, Miss.	WVOM	1270
Jackson, Ala.	WHOD	1290
Jackson, Ga.	WJGA	1540
Jackson, Ky.	WEKG	810
Jackson, Mich.	WIBM	1450
	WKHM	970
Jackson, Miss.	WJCO	1510
	WJDX	620
	WJQS	1400
	WJXN	1450
	WOKJ	1550
	WWUN	1590
	WRBC	1300
	WSLI	930
Jackson, Ohio	WLMJ	1280
Jackson, Tenn.	WDXI	1310
	WJAK	1450
	WTJS	1390
Jackson, Wis.	WYLO	540
Jackson, Wyo.	KSGT	1340
Jacksonville, Ark.	KGMR	1500
Jacksonville, Fla.	WJAX	930
	WAPE	690
	WBOM	970
	WVOJ	1320
	WIVY	1050
	WMBR	1460
	WOBS	1360
	WPDQ	600
	WQIK	1090
	WRHC	1400
Jacksonville, Ill.	WJIL	1550
	WLDS	1180
Jacksonville, N.C.	WJNC	1240
	WBBS	1290
	WLAS	910
Jacksonville, Tex.	KEBE	1400
Jacksonville Bch., Fla.	WBIX	1010
Jamestown, Ky.	WJKY	1060
Jamestown, N.Dak.	KEYJ	1400
	KSJB	600
Jamestown, N.Y.	WJTN	1240
	WKSN	1340
Jamestown, Tenn.	WCLC	1260
	WDEB	1500
Janesville, Wis.	WCLO	1230
Jasper, Ala.	WWWB	1360
	WARF	1240
Jasper, Ind.	WITZ	990
Jasper, Tex.	KTXJ	1350
Jefferson City, Mo.	KLLK	950
	KWOS	1240
Jefferson City, Tenn.	WJFC	1480
Jeffersonville, Ind.	WXVW	1450
Jena, La.	KCKW	1480
Jenkins, Ky.	WREN	1000
Jennings, La.	KJEF	1290
Jerome, Idaho	KART	1400
Jerseyville, Ill.	WJBM	1480
Jesup, Ga.	WLOP	1370
John Day, Ore.	KJDY	1400
Johnson City, Tenn.	WJCW	910
	WETB	790
Johnstown, N.Y.	WIZR	930
Johnstown, Pa.	WJAC	850
	WARD	1490
	WCRO	1230
Joliet, Ill.	WJOL	1340
	WJRC	1510
Joliette, Que.	CJLM	1350
Jonesboro, Ark.	KBTM	1230
	KNEA	970
Jonesboro, La.	KTOC	920
Jonesboro, Tenn.	WJSO	1590
Jonesville, La.	KANV	1480
Joplin, Mo.	WMBH	1450
	KQYX	1560
	KFSB	1310
	KODE	1230
Joshua Tree, Cal.	KJST	1420
Junction, Tex.	KMBL	1450
Junc. City, Kans.	KJCK	1420
Juneau, Alaska	KINY	800
	KJNO	630
Jupiter, Fla.	WJST	1000
Kahalui, Hawaii	KNUI	1310
Kailua, Hawaii	KLEI	1420
Kalamazoo, Mich.	WKPR	1420
	WZKO	590
	WKMI	1360
	WYYY	1470
Kallspell, Mont.	KGEZ	690
	KOFI	1180
Kane, Pa.	WKZA	960
Kankakee, Ill.	WKAN	1320
Kannapolis, N.C.	WGTL	870
	WRKB	1460
Kans. City, Kans.	KCKN	1340
Kansas City, Mo.	KCMO	810
	KMBZ	980
	KPRS	1590
	WOAF	610
	WHB	710
Kaukauna, Wis.	WKAU	1050
Kenedy-Karnes City, Texas	KAML	990
Kealakekua, Hawaii	KONA	790
	KKON	740
Kearney, Nebr.	KGFW	1340
	KRNY	1460
Keene, N.H.	WKNE	1290
	WKBK	1220
Kelso, Wash.	KLOG	1490
Kemmerer, Wyo.	KMER	950
Kendallville, Ind.	WAWK	1140
Kenedy, Tex.	KAML	990
Kennett, Mo.	KBOA	830
	KBXM	1540
Kennewick, Wash.	KNOA	1340
Kennewick-Pasco-Richland, Wash.	WEPR	610
Kenosha, Wis.	WLIP	1050
Kent, O.	WKNT	1520
Keokuk, Iowa	KOKX	1310
Kermit, Tex.	KERB	600
Kerrville, Tex.	KERV	1230
Kershaw, S.C.	WKSC	1300
Ketchikan, Alaska	KTKN	930
Kewanee, Ill.	WKEY	1450
Keyser, W.Va.	WKLP	1390
Key West, Fla.	WKWF	1600
	WHIZ	1500
Kilgore, Tex.	KOCA	1240
Killeen, Tex.	KLEN	1050
Kimball, Nebr.	KIMB	1260
King, N.C.	WKTE	1090
King City, Calif.	KRKC	1490
Kingman, Ariz.	KAAA	1230
Kings Mountain, N.C.	WKMT	1220
Kingsport, Tenn.	WKIN	1320
	WKPT	1400
	WGOC	1090
Kingston, N.Y.	WBAZ	1550
	WGHQ	920
	WKNY	1490
Kingstree, S.C.	WDKD	1310
	WKSP	1090
Kingsville, Tex.	KINE	1330
Kingwood, W.Va.	WFSP	1560
Kinston, N.C.	WELS	1010
	WFTC	960
	WISP	1230
Kirkland, Wash.	KYAC	1460
	KBLE	1050
Kirksville, Mo.	KIRX	1450
Kissimmee, Fla.	WFIV	1080
	WACY	1220
Kittanning, Pa.	WACB	1380
Klamath Falls, Oreg.	KAGO	1150
	KFLW	1450
Knoxville, Iowa	KNIA	1340
Knoxville, Tenn.	WBIR	1240
	WIVK	850
	WJBE	1430
	WATE	620
	WKGN	1340
	WKXV	900
	WNOX	990
	WROL	1490
	WSKT	1580
Kokomo, Ind.	WIOU	1350
Kosciusko, Miss.	WKOZ	1340
Laconia, N.H.	WLNH	1350
	WEMJ	1490
LaCrosse, Wis.	WKBH	1410
	WLCX	1490
	WKTY	580
Ladysmith, Wis.	WLDY	1340
Lafayette, Ga.	WLFA	1590
Lafayette, Ind.	WASK	1450
	WAZY	1410
	WBAA	920
Lafayette, La.	KPEL	1420
	KVOL	1330
	KXKW	1520
Lafayette, Tenn.	WEEN	1460
LaFollette, Tenn.	WLAF	1450
LaGrande, Oreg.	KLBM	1450
LaGrange, Ga.	WLAG	1240
	WTRP	620
LeGrange, Ill.	WTAQ	1300
LaGrange, Tex.	KVLG	1570
LaJunta, Colo.	KBZZ	1400
Lake Charles, La.	KLOU	1580
	KPLC	1470
	KAOK	1400
Lake City, Fla.	WDSR	1340
Lake City, Fla.	WDSR	1340
	WGRO	960
Lake City, S.C.	WJOT	1260
Lake Geneva, Wis.	WMIR	1550
Lakeland, Fla.	WLAK	1430
	WONN	1230
	WWAS	1330
Lake Placid, N.Y.	WIRD	920
Lakeport, Cal.	KBLC	1270
Lake Providence, La.	KLPL	1050
Lake Tahoe, Calif.	KOWL	1490
Lakeview, Oreg.	KQIK	1230
Lake Wales, Fla.	WIPC	1280
Lakewood, Colo.	KLAK	1600
Lakewood Center, Wash.	KODD	1480
Lake Worth, Fla.	WLIZ	1380
Lamar, Colo.	KLMR	920
Lamesa, Tex.	KPET	690
Lampasas, Tex.	KCYL	1450
Lancaster, Calif.	KAVL	610
	KBVM	1380
Lancaster, Ky.	WIXI	1280
Lancaster, N.Y.	WMMJ	1300
Lancaster, Ohio	WHOK	1520
Lancaster, Pa.	WGAL	1490
	WLAN	1390
Lancaster, S.C.	WLCM	1360
	WAGL	1560
Lander, Wyo.	KOVE	1330
Lanett, Ala.	WRLD	1490
Langdon, N.D.	KNDX	1080
Lansdale, Pa.	WNPV	1440
Lansford, Pa.	WLSH	1410
Lansing, Mich.	WILS	1320
	WJIM	1240
	WITL	1010
Lapeer, Mich.	WMPC	1230
	WTHM	1530
LaPlata, Md.	WSMD	1560
LaPorte, Ind.	WLOI	1540
Laramie, Wyo.	KLME	1490
	KOWB	1290
Laredo, Tex.	KLAR	1300
	KVOZ	1490
Larned, Kans.	KANS	1510
LaSalle, Ill.	WLPO	1220
LasCruces, N.Mex.	KOBE	1460
	KGRT	570
Las Vegas, Nev.	KENO	1460
	KLAV	1230
	KRAM	1340
	KLUC	1140
	KOBK	920
	KVEG	970
Las Vegas, N.Mex.	KFUN	1230
Latrobe, Pa.	WPKV	1570
	WQTW	1570
	WTRA	1480

Location	C.L.	kHz
Laurel, Md.	WLMD	900
Laurel, Miss.	WAML	1340
	WLAU	1430
	WNSL	1260
	WLBG	860
Laurens, S.C.	WEWO	1080
Laurinburg, N.C.	WLNC	1300
Lawrence, Kans.	KFKU	1250
	KLWN	1320
Lawrence, Mass.	WCCM	800
Lawrenceburg, Tenn.	WDXE	1370
Lawrenceville, Ga.	WLAW	1360
Lawrenceville, Ill.	WAKO	910
Lawrenceville, Va.	WLES	580
Lawton, Okla.	KSWO	1380
	KCCO	1050
Leadville, Colo.	KBRR	1230
Leaksville, N.C.	WLOE	1490
Leavenworth, Kans.	KCLO	1410
Lebanon, Ky.	WLBN	1590
Lebanon, Mo.	KLWT	1230
Lebanon, Oreg.	KGAL	920
Lebanon, Pa.	WLBR	1270
Lebanon, Tenn.	WCOR	900
Leesburg, Fla.	WLBE	790
	WZST	1410
Leesburg, Va.	WAGE	1290
Leesville, La.	KLLA	1570
Lehigh Acres, Fla.	WAYK	1440
Lehighton, Pa.	WYNS	1150
Leitchfield, Ky.	WMTL	1580
Leland, Miss.	WESY	1580
LeMars, Iowa	KLEM	1410
Lemmon, S.D.	KBJM	1400
Lemoore, Calif.	KLAN	1320
	KOAD	1240
Lenoir, N.C.	WJRI	1340
	WKGX	1080
Lenoir City, Tenn.	WBLC	1360
	WLIL	730
Leominster, Mass.	WLMS	1000
Leonardtown, Md.	WKIK	1370
Levelland, Tex.	KLVT	1230
Levittown, Pa.	WBCB	1490
Lewisburg, Pa.	WUDO	1010
Lewisburg, Tenn.	WJJM	1490
Lewiston, Idaho	KRLC	1350
	KOZE	1300
Lewiston, Maine	WCOU	1240
	WLAM	1470
Lewistown, Mont.	KXLO	1230
Lewistown, Pa.	WKVA	920
	WMRF	1490
Lexington, Ky.	WLAP	630
	WBLG	1300
	WVLK	590
Lexington, Miss.	WXTN	1000
Lexington, Mo.	KLEX	1570
Lexington, Neb.	KRVN	880
Lexington, N.C.	WBUY	1440
Lexington, Tenn.	WDXL	1490
Lexington, Va.	WREL	1450
Lexington Pk., Md.	WPTX	920
Libby, Mont.	KLCB	1230
Liberal, Kans.	KSCB	1270
	KLIB	1470
Liberty, Ky.	WKDO	1560
Liberty, Mo.	KBIL	1140
Liberty, N.Y.	WVOS	1240
Liberty, Tex.	KPXE	1050
Lihue, Hawaii	KTOH	1350
Lima, Ohio	WIMA	1150
	WCIT	940
Lincoln, Ill.	WPRC	1370
Lincoln, Me.	WLKN	1450
Lincoln, Nebr.	KFOR	1240
	KLIN	1400
	KLMS	1480
	KECK	1530
Lincolnton, N.C.	WLON	1050
Lineville, Ala.	WANL	1540
Linton, Ind.	WBTO	1600
Litchfield, Ill.	WSMI	1540
Litchfield, Minn.	KLFD	1410
Little Falls, Minn.	KLTF	960
Little Falls, N.Y.	WLFH	1230
Littlefield, Tex.	KZZN	1490
Little Rock, Ark.	KARK	920
	KALO	1250
	KLRA	1010
	KOKY	1440
	KAAY	1090
	KMYO	1050
Littleton, Colo.	KDKO	1510
Littleton, N. H.	WLTN	1400
Live Oak, Fla.	WNER	1250
Livingston, Mont.	KPRK	1340
Livingston, Tenn.	WLIV	920
Livingston, Tex.	KETX	1440
Lockhart, Tex.	KHRB	1060
Lock Haven, Pa.	WBPZ	1230
Lockport, N.Y.	WUSJ	1340
Lodi, Calif.	KCVR	1570
Logan, O.	WLGN	1510
Logan, Utah	KBLW	1390
	KSTU	1300
	KVNU	610
Logan, W.Va.	WLOG	1230
	WVOW	1290
Logansport, Ind.	WSAL	1230
Lompoc, Calif.	KKOK	1410
	KLOM	1330
	KNEZ	960

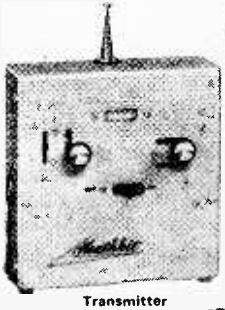
Location	C.L.	kHz
London, Ky.	WFTG	1400
Long Beach, Calif.	KFOX	1280
	KGER	1390
Longmont, Colo.	KLMO	1060
Long Prairie, Minn.	KEYL	1400
Longview, Tex.	KFRD	1370
	KLUE	1280
Longview, Wash.	KEDO	1400
	KBAM	1270
Lookout Mtn., Tenn.	WFLI	1070
Lorain, O.	WIRO	1230
Loretto, Pa.	WWSF	1400
Loris, S.C.	WLSC	1570
Los Alamos, N.Mex.	KRNS	1490
Los Angeles, Calif.	KABC	790
	KFI	640
	KHJ	930
	KFWB	980
	KGFJ	1230
	KFAC	1330
	KLAC	570
	KMPC	710
	KNX	1070
	KPOL	1540
	KGBS	1020
	KRKD	1150
Los Banos, Calif.	KLBS	1330
Louisburg, N.C.	WYRN	1480
Louisville, Ga.	WPEH	1420
Louisville, Ky.	WAVE	970
	WAKY	790
	WHAS	840
	WKLO	1080
	WINN	1240
	WFIA	900
	WLOU	1350
	WTMT	620
Louisville, Miss.	WLSM	1270
Loveland, Colo.	KLOV	1570
Loves Park, Ill.	WLUV	1520
Lovington, N.Mex.	KLEA	630
Lowell, Mass.	WCAP	980
	WLLH	1400
Lubbock, Tex.	KCBD	1590
	KDAV	580
	KLBK	1340
	KLFB	1420
	KFYO	790
	KLLL	1460
	KSEL	950
Lucedale, Miss.	WHHT	1440
Ludington, Mich.	WKLA	1450
Lufkin, Tex.	KRBA	1340
	KTRE	1420
Lumberton, N.C.	WAGR	580
	WTSB	1340
Luray, Va.	WRAA	1330
Lynchburg, Va.	WLVA	590
	WLLL	930
	WLGM	1320
	WWOD	1390
	WBRG	1050
Lynn, Mass.	WLYN	1360
Lyons, Ga.	WBBT	1340
Machias, Me.	WMCS	1400
Macomb, Ill.	WKAI	1510
Macon, Ga.	WBML	1240
	WCRY	900
	WDEN	1500
	WIBB	1280
	WMAZ	940
	WNEX	1400
Macon, Mo.	KLTI	1560
Madawaska, Me.	WSJR	1230
Madera, Calif.	KHOT	1250
Madill, Okla.	KMAD	1550
Madison, Fla.	WMAF	1230
Madison, Ga.	WYTH	1250
Madison, Ind.	WORX	1270
Madison, S.D.	KJAM	1390
Madison, Tenn.	WENO	1430
Madison, Wis.	WHA	970
	WIBA	1310
	WISM	1480
	WKOW	1070
	WMAD	1550
Madisonville, Ky.	WFMW	730
	WTTL	1310
Madisonville, Tenn.	WKYZ	1250
Magee, Miss.	WSJC	810
Magnolia, Ark.	KVMA	630
Maksville, N.C.	WDSL	1520
Malden, Mo.	KTCB	1470
Malone, N.Y.	WICY	1490
Malvern, Ark.	KBOK	1310
Manassas, Va.	WPRW	1460
Manati, P.R.	WMNT	1500
Manchester, Conn.	WINF	1230
Manchester, Ga.	WFDR	1370
Manchester, Ky.	WWXL	1450
Manchester, N.H.	WFEA	1370
	WGIR	610
	WKBR	1250
Manchester, Tenn.	WMSR	1320
Manhattan, Kans.	KSAC	580
	KMAN	1350
Manistee, Mich.	WMTE	1340
Manistique, Mich.	WTIQ	1490
Manitou Springs, Colo.	KCMS	1490
Manitowoc, Wis.	WCUB	980
	WOMT	1240
Mankato, Minn.	KYSM	1230
	KTOE	1420

Location	C.L.	kHz
Manning, S.C.	WYMB	1410
Mansfield, La.	KDXI	1360
Mansfield, Ohio	WMAN	1400
	WCLW	1140
Maplewood, Minn.	WJSW	1010
Maquoketa, Iowa	KMAQ	1320
Marathon, Fla.	WFEG	1300
Marianna, Ark.	KZOT	1460
Marianna, Fla.	WTYS	1340
	WTOT	980
Marietta, Ga.	WFOM	1230
	WBIE	1080
Marietta, Ohio	WMOA	1490
	WBRJ	910
Marine City, Mich.	WSMA	1590
Marionette, Wisc.	WMAN	570
	WLOT	1300
Marion, Ala.	WJAM	1310
Marion, Ill.	WGGH	1150
Marion, Ind.	WBAT	1400
	WMRI	860
Marion, Ky.	WMJL	1010
Marion, N.C.	WBRM	1250
Marion, Ohio	WMRN	1490
Marion, S.C.	WATP	1430
Marion, Va.	WMEV	1010
	WOLD	1330
Marked Tree, Ark.	KPCA	1580
Marks, Miss.	WQMA	1520
Marksville, La.	KAPB	1370
Marlborough, Mass.	WSRO	1470
Marquette, Mich.	WDMJ	1320
Marshall, Minn.	KMHL	1400
Marshall, Mo.	KMMO	1300
Marshall, N.C.	WMMH	1460
Marshall, Tex.	KMHT	1450
	KDOX	1410
Marshalltown, Iowa	KFJB	1230
	KEMN	1510
Marshfield, Wis.	WDLG	1450
Martin, Tenn.	WCMT	1410
Martinsville, Ind.	WCBK	1540
Martinsburg, Pa.	WJSM	1110
Martinsburg, W.Va.	WEPM	1340
Martinsville, Va.	WHEE	1370
	WMVA	1450
Maryville, Mo.	KNIM	1580
Marysville, Calif.	KMYC	1410
Marysville, Kans.	KNDY	1570
Maryville, Tenn.	WGAP	1400
Mason, Mich.	WUNN	1110
Mason City, Iowa	KGLO	1300
	KRIB	1490
	KSMN	1010
Massena, N.Y.	WMSA	1340
	WYBG	1050
Massillon, Ohio	WTIG	990
Matewan, W.Va.	WHJC	1360
Mattoon, Ill.	WLBH	1170
Mauston, Wis.	WRJC	1270
Mayaguez, P.R.	WAEL	600
	WKJB	710
	WORA	760
	WPRA	990
	WTIL	1300
Mayfield, Ky.	WNGO	1320
Mayodan, N.C.	WMYN	1420
Mayville, N.D.	KMAV	1520
Maysville, Ky.	WFTM	1240
McAlester, Okla.	KTMC	1400
	KNED	1150
McAllen, Tex.	KRIO	910
McCall, Ida.	KMCL	1240
McComb, Miss.	WHNY	1250
	WAPF	980
McCook, Nebr.	KBRL	1300
	KICX	1360
McFarland, Cal.	KXEM	1590
McGehee, Ark.	KVSA	1220
McKeesport, Pa.	WEDO	810
	WIXZ	1360
McKenzie, Tenn.	WHDM	1440
McKinney, Tex.	KYAL	1600
McLeansboro, Ill.	WMCL	1060
McMinnville, Oreg.	KMCM	1260
McMinnville, Tenn.	WBMC	960
	WAKI	1230
McPherson, Kans.	KNEX	1540
McRae, Ga.	WDAX	1410
Meadville, Pa.	WMGW	1490
Medford, Mass.	WHIL	1430
Medford, Oreg.	KMED	1440
	KSHA	860
	KDOV	1300
	KBOY	730
	KYJC	1230
Medford, Wis.	WIGM	1490
Media, Pa.	WXUR	690
Melbourne, Fla.	WNMB	1240
Memphis, Tenn.	WHBQ	560
	WHER	1430
	WMC	790
	WDIA	1070
	WMPS	680
	WLOK	1340
	WMQM	1480
	WREC	600
	KWAM	990
Memphis, Tex.	KBGH	1130
Mena, Ark.	KENA	1450
Mendota, Ill.	WGLC	1090
Meendoeino, Cal.	KMFB	1300
Menominee, Mich.	WAGN	1340

Location	C.L.	kHz
Menomenie, Wis.	WMNE	1360
Merced, Calif.	KYOS	1480
	KWIP	1580
Meriden, Conn.	WMMW	1470
Meridian, Miss.	WCOC	910
	WDAL	1330
	WMOX	1010
	WOKK	1450
	WQIC	1390
Merkle, Tex.	KWFA	1500
Merrill, Wis.	WXMT	730
Mesa, Ariz.	KBUZ	1310
	KALF	1510
Metropolis, Ill.	WMOK	920
Metter, Ga.	WMAC	1360
Mexia, Tex.	KBUS	1590
Mexico, Mo.	KXEO	1340
Mexico, Pa.	WJUN	1220
Miami, Ariz.	KIKO	1340
Miami, Fla.	WGBS	710
	WIOD	610
	WFAB	990
	WFUN	790
	WWOK	1260
	WLTO	1220
	WQAM	560
	WQBA	1140
	WOCN	1140
	WINZ	940
Miami, Okla.	KGLC	910
Miami Beach, Fla.	WMBM	1490
	WKAT	1360
Michigan City, Ind.	WIMS	1420
Middlebury, Vt.	WFAD	1490
Middleport-Pomeroy, Ohio	WMPO	1390
Middlesboro, Ky.	WMIK	560
	WAFI	1560
Middletown, Conn.	WCNX	1150
Middletown, N.Y.	WALL	1340
Middletown, Ohio	WPFB	910
Midland, Mich.	WMDN	1490
Midland, Tex.	KCRS	550
	KJBC	1150
	KWEL	1600
	KABH	1510
Milan, Tenn.	WKBJ	1600
Miles City, Mont.	KATL	1340
Milford, Conn.	WFIF	1500
Milford, Del.	WTHD	930
Milford, Mass.	WMRC	1490
Milledgeville, Ga.	WMVG	1450
Millen, Ga.	WGSR	1570
Millington, Tenn.	WTNN	1380
Millinocket, Me.	WMKR	1240
Millville, N.J.	WMJR	1440
	WSRA	1490
Milton, Fla.	WEBY	1330
Milton, Pa.	WMLP	1380
	WSRA	1490
	WARC	1380
Milwaukee, Wis.	WEMP	1250
	WRIT	1340
	WISN	1130
	WMIL	1290
	WNOV	860
	WOKY	920
	WTMJ	620
Minden, La.	KASO	1240
Mineola, N.Y.	WTHE	1520
Mineola, Tex.	KMOO	1510
Mineral Wells, Tex.	KORC	1140
Minneapolis, Minn.	WCCO	830
	WLOL	1330
	WMIN	1400
	WDGY	1130
	WWTC	1280
	KTCR	690
	KTIS	900
	KUOM	770
	KSTP	1500
Minot, N. Dak.	KLPM	1390
	KHRT	1320
	KCJB	910
	KTYN	1430
Mission, Kans.	KBEA	1480
Mission, Tex.	KIRT	1580
Missoula, Mont.	KGVO	1290
	KGMY	1450
	KYLT	1340
	KYSS	930
Mitchell, S.Dak.	KORN	1490
Moab, Utah	KURA	1450
Moberly, Mo.	KWIX	1230
Mobile, Ala.	WUNI	1410
	WABB	1480
	WGDK	900
	WMOO	1550
	WMOB	840
	WKRG	710
	WLIQ	1360
	WMOZ	960
Mobridge, S.Dak.	KOLY	1300
Mocksville, N.C.	WDSL	1520
Modesto, Calif.	KTRB	860
	KBEE	970
	KFIV	1360
Mojave, Calif.	KDOL	1340
Moline, Ill.	WQUA	1230
Monahans, Tex.	KVKM	1330
Moncks Corner, S. C.	WBER	950
Monett, Mo.	KRMO	990

4 New Action-Packed Kits from Heath

Heathkit GD-101
$49.95*



Transmitter

Heathkit GD-57
$129.95*

Receiver

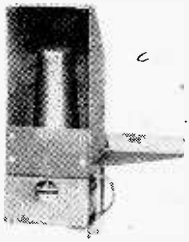
Battery Pack

Servos

Heathkit Siren & Speaker
$99.95*

Amplifier & Controls

Exterior Horn



Concealed Horn

Heathkit MI-29
$84.95*

NEW Heathkit "Spectre" ⅛ Scale R/C Car
Join The Most Exciting New Hobby In America . . .

building and racing radio-controlled Grand Prix cars up to scale speeds of 200 mph. The Heathkit "Spectre" R/C car reaches that speed and has already proven itself a winner. And no wonder; its design is unique. It has a chrome plated steel chassis, adjustable caster and toe-in, specially formulated rubber tires that lock onto the cast nylon wheels, independent front suspension for excellent cornering and a 5.5:1 gear ratio for maximum torque at all speeds. The snap on, ⅛ scale car body (length: 19¼") is of high impact plastic — almost indestructable. Suspension is by real coil springs. The radio equipment compartment is dirt and oil proof. The Heathkit "Spectre" is the only complete car kit available. You get the body, chassis, wheels & tires, 4 oz. fuel tank & tubing, equipment case & protective foam, centrifugal clutch & gears, axles, servo linkages & mounting tape, all hardware, decals, numbers and a comprehensive manual. The "Spectre" accepts any .15 to .23 cubic inch R/C engine and any proportional R/C electronics system. It requires only two servos to operate the steering, brake and throttle. Get in on all the thrills of R/C car racing at the lowest possible price . . . order a Heathkit "Spectre".

Kit GD-101, R/C car only, 8 lbs.....**$49.95***
Assembled GDA-101-1, Veco .19 R/C engine, 1 lb.....**$19.95***

NEW Heathkit 3-Channel Digital Proportional R/C System
For Planes, Gliders, Cars And Boats

Ideal for use with the new Heathkit "Spectre" R/C car to give you total control . . . ease of handling. Here's what the Heathkit GD-57 R/C system includes: Transmitter with assembled, factory aligned RF circuitry; new 2 oz. miniature receiver that needs no IF alignment, in a tough nylon case; you also get two servos; all plugs; connectors; cables; charging cord; new flat-pack rechargeable nickel-cadmium transmitter and receiver batteries . . . and a special soldering iron. You can have your choice of five operating frequencies in each of three bands . . . 27, 53 or 72 MHz. This is the most value ever offered in a 3-channel rig.

Kit GD-57, transmitter, receiver, 2 servos, batteries, charging cord, switches and soldering iron, (specify freq. desired), 11 lbs.....**$129.95***
Kit GDA-57-1, transmitter, battery, charging cord, (specify freq. desired), 5 lbs.....**$54.95***
Kit GDA-57-2, receiver only, (specify freq.), 1 lb.....**$34.95***

NEW Heathkit Siren/PA
For Licensed Emergency Vehicle Only

Hey Chief! Save up to 60% on a new electronic siren/PA system by ordering the low cost Heathkit GD-18. The siren gives both "wail" and "yelp" warnings at 50 watts output power, and you can adjust the pitch. As a public address it will amplify your voice with a full 20 watts of power, and it's practically immune to acoustical feedback. (Either PA or siren can be interrupted to use the other.) Incoming radio calls can be channeled through the GD-18 so you can hear them when away from your vehicle. Use it on any 12-volt auto electrical system with either positive or negative frame ground. It will operate from -20° to 150° F conditions. Control panel is lighted. Comes with gimbal bracket mounting. Take your choice of speakers . . . concealed or exposed.

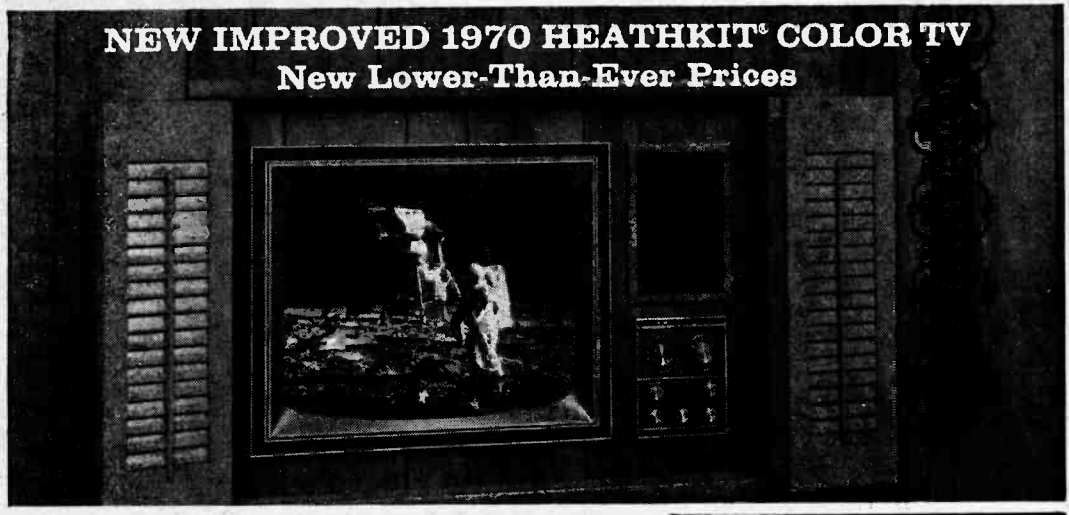
Kit GD-18, Siren/PA Amplifier, 7 lbs.....**$54.95***
Assembled GDA-18-1, Exterior Horn, 9 lbs.....**$49.95***
Assembled GDA-18-2, Concealed Horn, 4½ x 4½ x 13", 9 lbs.....**$49.95***
System GD-18A, (includes GD-18 plus exterior horn), 16 lbs.....**$99.95***
System GD-18B, (includes GD-18 plus concealed horn), 16 lbs.....**$99.95***

NEW Heathkit Solid-State Portable Fish Spotter

Costs half as much as comparable performers. Probes to 200 ft. Doubles as depth sounder. Transducer mounts anywhere on suction cup bracket. Adjustable Sensitivity Control. Exclusive Noise-Rejection Control stops ignition noise. Runs for 80 hrs. on two 6 VDC lantern batteries (not included). Manual explains typical dial readings. Get set for next season; order your Heathkit MI-29 today.

Kit MI-29, 9 lbs.....**$84.95***

NEW IMPROVED 1970 HEATHKIT® COLOR TV
New Lower-Than-Ever Prices



Here's How The Color TV That Thousands Call Best Became Even Better and Lower In Price

Since the very first model was introduced, thousands of owners, electronic experts, and testing labs have praised the superior color picture quality and extra features of Heathkit ColorTV. Now Heath has made improvements that make the 1970 models even better.

Sharper, More Detailed Pictures. Latest design improvement in the circuitry of Heathkit Color TV video amplifiers has increased their bandpass capabilities. The result is an increase in the number of lines of resolution . . . greater than in any other brand of color TV we have tested. This improvement means you get sharper, more detailed pictures as shown by test pattern measurements. You not only get the superior *color* pictures Heathkit Color TV has always been noted for, but you also get sharper pictures.

New Brighter Tube. Now all Heathkit Color TV models include the new brighter picture tube you've read so much about. These new tubes produce noticeably brighter pictures with more life-like, natural colors and better contrast. (We also offer the RCA Hi-Lite Matrix tube as an extra-cost option for the Heath GR-681 and GR-295 kits.)

New Safety Features. As an added safety precaution, AC interlocks have been added to all Heathkit Color TV cabinets.

Now The Best Costs Less. How can Heath make improvements in its Color TV Models and still reduce the prices? We have passed on to you the savings which have accrued due to reduced picture tube prices. The result is your 1970 Heathkit Color TV will cost you $20 to $55 less depending upon which model you choose . . . proof that Heathkit Color TV is a better buy than ever.

All Heathkit Color TV's Have These Superior Features

• New brighter American brand rectangular color tube with bonded-face, etched anti-glare safety glass • Exclusive built-in self-servicing aids so you can adjust and maintain the set for best performance always • Automatic degaussing plus mobile degaussing coil • New broader video bandwidth for better resolution • 3-stage video IF • Improved retrace blanking • Gated automatic gain control for steady pictures • Automatic color control • Exclusive Magna-Shield surrounds picture tube for better color purity • Deluxe VHF tuner with "memory" fine tuning and precious metal contacts (models with automatic fine tuning also are available in all 3 picture tube sizes) • 2-speed UHF solid-state tuner • Completely shielded hi-voltage supply • Extra B+ boost for better definition • 2 hi-fi sound outputs for built-in speaker or your hi-fi system • 300 ohm & 75 ohm antenna inputs • Circuit breaker protection • Optional wireless remote control can be added anytime • Factory assembled and adjusted tuners, IF section, and hi-voltage supply • Exclusive 3-way installation capability — in a wall, custom cabinet or Heath cabinets

Choose Your Heathkit Color TV Now . . .
It's Better Than Ever in Performance . . . and A Better Buy Than Ever

New Lower-Than-Ever Prices On All Models

Heathkit GR-681
(295"-AFT)
save $30
Now only **$469.95***

Heathkit GR-681MX
(with Matrix tube)
save $55
Now only **$479.95***

Heathkit GR-295
(295")
save $30
Now only **$419.95***

Heathkit GR-295MX
(with Matrix tube)
save $55
Now only **$429.95***
cabinets from $65*

Heathkit GR-681
(227"-AFT)
save $20
Now only **$399.95***

Heathkit GR-227
(227")
save $20
Now only **$359.95***
cabinets from $39.95*

Heathkit GR-481
(180"-AFT)
save $30
Now only **$329.95***

Heathkit GR-180
(180")
save $30
Now only **$299.50***
cabinets from $27.50*

NEW FREE 1970 CATALOG!
Now with more kits, more color. Fully describes these along with over 300 kits for stereo/hi-fi, color TV, electronic organs, guitar amplifiers, amateur radio, marine, educational, CB, home & hobby. Mail coupon or write Heath Company, Benton Harbor, Michigan 49022.

HEATH COMPANY, Dept. 19-6
Benton Harbor, Michigan 49022

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a Schlumberger company

☐ Enclosed is $_____, plus shipping.

Please send model (s)_____
☐ Please send FREE Heathkit Catalog. ☐ Please send Credit Application.

Name_____

Address_____

City_____ State_____ Zip_____

*Mail order prices; F.O.B. factory. Prices & specifications subject to change without notice. CL-375

WHITE'S RADIO LOG

Location	C.L.	kHz
Monette, Ark.	KBIB	1560
Monmouth, Ill.	WRAM	1330
Monroe, Ga.	WMRE	1490
Monroe, La.	KMLB	1440
	KLIC	1230
	KNOE	540
Monroe, Mich.	WQTE	560
	WMAP	1060
Monroe, N.C.	WIXE	1190
Monroe, Wis.	WEKZ	1260
Monroeville, Ala.	WMFC	1360
Monterey, Calif.	KIDD	630
	KMBY	1240
Montevideo, Minn.	KDMA	1460
Monte Vista, Colo.	KSLV	1240
Montezuma, Ga.	WMNZ	1050
Montgomery, Ala.	WBAM	740
	WAPX	1600
	WCOV	1170
	WHHY	1440
	WMGY	800
	WRMA	950
	WQTY	1500
Montgomery, W.Va.	WMON	1340
Monticello, Ark.	KHBM	1430
Monticello, Fla.	WWSD	1090
Monticello, Ky.	WFLW	1360
Monticello, Miss.	WMLC	1270
Montpelier, Ida.	KVSI	1450
Montpelier-Barre, Vt.	WSKI	1240
Montrose, Colo.	KUBC	580
Montrose, Pa.	WPEL	1250
Mooresville, N.C.	WHIP	1350
Moorhead, Minn.	KVOX	1280
Morehead, Ky.	WMOR	1330
Morehead City, N.C.	WMBL	740
Morgan City, La.	KMRC	1430
Morganfield, Ky.	WMSK	1550
Morganton, N.C.	WMNC	1430
Morgantown, W.Va.	WAJR	1440
	WCLG	1300
Morrilton, Ark.	KVOM	800
Morris, Ill.	WCSJ	1550
Morris, Minn.	KMRS	1230
Morristown, N.J.	WMTR	1250
Morristown, Tenn.	WCRK	1150
	WMTN	1300
Morton, Tex.	KRAN	1280
Moscow, Idaho	KRPL	1400
Moses Lake, Wash.	KSEM	1470
	KWIQ	1260
Moss Point, Miss.	WCIS	1480
Moulton, Ala.	WLCB	1530
Moultrie, Ga.	WMGA	1130
	WMTM	1300
Moundsville, W.Va.	WEIF	1370
Mountain City, Tenn.	WMCT	1390
Mountain Grove, Mo.	KLRS	1360
Mountain Home, Ark.	KTLO	1240
Mountain Home, Ida.	KFLI	1240
Mountainlake Terrace, Wash.	KURB	1510
Mt. Airy, N.C.	WPAQ	740
	WSYD	1300
Mt. Carmel, Ill.	WVMC	1360
Mt. Carmel, Pa.	WMIM	1590
Mt. Clemens, Mich.	WBRB	1430
Mt. Dora, Fla.	WVGT	1580
Mt. Holly, N.J.	WJJZ	1460
Mt. Jackson, Va.	WSIG	790
Mt. Kisco, N.Y.	WVIP	1310
Mt. Olive, N.C.	WDJS	1430
Mt. Pleasant, Mich.	WCEN	1150
Mt. Pleasant, Tex.	KIMP	960
Mt. Shasta, Calif.	KWSD	620
Mt. Sterling, Ky.	WMST	1150
Mt. Vernon, Ill.	WMIX	940
Mt. Vernon, Ind.	WPCO	1590
Mt. Vernon, Ky.	WRVK	1480
Mt. Vernon, Ohio	WMVO	1300
Mt. Vernon, Wash.	KAPS	1470
	KBRC	1430
Muleshoe, Tex.	KMUL	1380
Mullins, S.C.	WJAY	1280
Muncie, Ind.	WLBC	1340
	WERK	990
Munfordville, Ky.	WLOC	1150
Munsing, Mich.	WGON	1400
Murfreesboro, N. C.	WWDR	1080
Murfreesboro, Tenn.	WGNS	1450
	WMTS	810
Murphy, N.C.	WCVP	600
	WKRK	1320
Murphysboro, Ill.	WINI	1420
Murray, Ky.	WNBS	1340
Murray, Utah	KMOR	1230
Muscatine, Iowa	KWPC	860
Muscle Shoals City, Ala.	WLAY	1450
Muskegon, Mich.	WKBZ	850
	WKJR	1520
	WTRU	1600
	WMUS	1090
Muskogee, Okla.	KBIX	1490
	KMUS	1380
Myrtle Beach, S.C.	WMYB	1450
	WTGR	1520
Nacogdoches, Tex.	KEEE	1230
	KSFA	860
Nampa, Idaho	KFXD	580
	KAIN	1340
Nanticoke, Pa.	WNAK	730
Napa, Calif.	KVON	1440
Naples, Fla.	WNOG	1270
Narrows-Pearlsburg, Va.	WNRV	990
Nashua, N.H.	WOTW	900
	WSMN	1590
Nashville, Ark.	KBHC	1260
Nashville, Ga.	WNGA	1600
Nashville, Tenn.	WKDA	1240
	WLAC	1510
	WMAK	1300
	WNAH	1360
	WSIX	980
	WSM	650
	WWGM	1560
Nassau, Bahamas	ZNS-2	1240
Natchez, Miss.	WMIS	1240
	WNAT	1450
Natchitoches, La.	KNOC	1450
Natick, Mass.	WGTR	1060
Naugatuck, Conn.	WOWW	1380
Navasota, Tex.	KWBC	1550
Nebraska City, Nebr.	KNCY	1600
Needles, Calif.	KSFE	1340
Neenah, Wis.	WNAM	1280
Neillsville, Wis.	WCCN	1370
Nelsonville, O.	WNAL	940
Neon, Ky.	WNKY	1480
Neosho, Mo.	KBTN	1420
Nevada, Mo.	KNEM	1240
New Albany, Ind.	WHEL	1570
	WREY	1290
New Albany, Miss.	WNAU	1470
Newark, Del.	WNRK	1260
Newark, N.J.	WVNJ	620
Newark, N.Y.	WACK	1420
Newark, Ohio	WCLT	1430
New Bedford, Mass.	WBSM	1420
	WNBH	1340
New Bern, N.C.	WHIT	1450
	WRNB	1490
Newberry, Mich.	WNBY	1450
Newberry, S.C.	WKDK	1240
	WKMG	1520
New Boston, Ohio	WIOI	1010
New Boston, Tex.	KNBO	1530
New Braunfels, Tex.	KGNB	1420
New Britain, Conn.	WRCH	910
	WRYM	840
New Brunswick, N.J.	WCTC	1450
Newburgh, N.Y.	WGNY	1220
Newburyport, Mass.	WNBY	1470
New Castle, Ind.	WCTW	1550
New Castle, Pa.	WBZ	1140
	WKST	1280
Newcastle, Wyo.	KASL	1240
New City, N.Y.	WRKL	910
New Haven, Conn.	WAVZ	1300
	WELI	960
	WNHC	1340
New Iberia, La.	KANE	1240
	KNIR	1360
New Kensington, Pa.	WKPA	1150
New London, Conn.	WNLC	1510
New Martinsville, W.Va.	WETZ	1330
Newnan, Ga.	WCOH	1400
	WNEA	1300
New Orleans, La.	WDSU	1280
	WJMR	990
	WBOK	800
	WNOE	1060
	WSMB	1350
	WNPS	1450
	WSHO	800
	WTIX	690
	WWL	870
	WWOM	600
	WYLD	940
Newport, Ark.	KNBY	1280
Newport, Ky.	WNOP	740
Newport, N.H.	WCNL	1010
Newport, Oreg.	KNPT	1310
Newport, R.I.	WADK	1540
Newport, Tenn.	WLIK	1270
Newport, Vt.	WIKE	1490
Newport News, Va.	WGH	1310
	WTID	1270
Newport Richey, Fla.	WGUL	1500
New Prague, Minn.	KTMF	1350
New Richmond, Wis.	WIXK	1590
New Roads, La.	KWRG	1500
New Rochelle, N.Y.	WVOX	1460
New Smyrna Beach, Fla.	WSBB	1230
	WOOD	1550
Newton, Iowa	KCOB	1280
Newton, Kans.	KJRG	950
Newton, Mass.	WNTN	1550
Newton, Miss.	WBKN	1410
Newton, N.J.	WNNJ	1360
Newtn, N.C.	WNNS	1230
New Ulm, Minn.	KNUJ	860
New York, N.Y.	WABC	770
	WADO	1280
	WBNX	1380
	WCBS	880
	WEVD	1330
	WHN	1050
	WHOM	1480
	WINS	1010
	WLIB	1190
	WMCA	570
	WNBC	660
	WNEW	1130
	WNYC	830
	WOR	710
	WPOW	1330
	WQXR	1560
	WWRL	1600
Niagara Falls, N.Y.	WHLD	1270
	WJJL	1440
Nicholasville, Ky.	WNVL	1250
Niles, Mich.	WNIL	1290
Niles, Ohio	WNIO	1540
Nogales, Ariz.	KFBR	1340
Nome, Alaska	KICY	850
Norfolk, Nebr.	WJAG	780
Norfolk, Va.	WTAR	790
	WCMS	1050
	WNOR	1230
	WRAP	850
Normal, Ill.	WIOK	1440
Norman, Okla.	WNAD	640
	KNOR	1400
Norristown, Pa.	WNAR	1110
N. Adams, Mass.	WMNB	1230
N. Atlanta, Ga.	WRNG	680
N. Augusta, S.C.	WGUS	1380
	WFNL	1660
N. Bend, Ore.	KBBR	1340
North Charleston, S.C.	WNCG	910
Northampton, Mass.	WHMP	1400
North East, Pa.	WHYP	1530
Northfield, Minn.	WCAL	770
	KYMN	1070
N. Little Rock, Ark.	KDXE	1380
	KXLR	1150
North Platte, Nebr.	KJLT	970
	KNOP	1410
	KODY	1240
North Pole, Alaska	KJND	1170
No. Syracuse, N.Y.	WSOQ	1220
N. Vernon, Ind.	WOCH	1460
No. Wilkesboro, N.C.	WKBC	810
Norton, Kans.	KNBI	1530
Norton, Va.	WNVA	1350
Norwalk, Conn.	WNLK	1350
Norwalk, O.	WLKR	1510
Norwich, Conn.	WICH	1310
Norwich, N.Y.	WCHN	970
Oakdale, La.	KREH	900
Oakes, N. Dak.	KEYD	1220
Oak Grove, La.	KWCL	1280
Oak Hill, W. Va.	WOAY	860
Oakland, Cal.	KNEW	910
	KABL	960
	KDIA	1310
Oakland, Md.	WMSG	1050
Oakland Park, Fla.	WIXX	1520
Oak Park, Ill.	WOPA	1490
Oak Ridge, Tenn.	WATO	1290
Ocala, Fla.	WMOP	900
	WTMC	1290
	WWKE	1370
Ocean City, Md.	WETT	1590
Ocean City, Somers Pt., N.J.	WSLT	1520
Oceanlake, Oreg.	KBCH	1380
Oceanside, Calif.	KUDE	1320
Ocilla, Ga.	WSIZ	1380
Oconto, Wis.	WOCO	1260
Odessa, Tex.	WBZB	920
	KOZA	1230
	KOYL	1310
	KRIG	1410
Oelwein, Iowa	KOEL	950
Ogallala, Nebr.	KOGA	930
Ogden, Utah	KLO	1430
	KANN	1090
	KSVN	730
	KVOG	1490
Ogdensburg, N.Y.	WSLB	1400
Oil City, Pa.	WKRZ	1340
Okeechobee, Fla.	WOKC	1570
Okla. City, Okla.	KBYE	890
	KLPR	1140
	KOCY	1340
	KOMA	1520
	KTOK	1000
	KJEM	800
	WKY	930
Okmulgee, Okla.	KOKL	1240
Old Saybrook, Conn.	WLIS	1420
Olean, N.Y.	WMNS	1360
	WHDL	1450
Olney, Ill.	WLLN	740
Olympia, Wash.	KGY	1240
	KITN	920
Omaha, Nebr.	KBON	1490
	KFAB	1110
	KOIL	1290
	KOOO	1420
	KOZN	660
	WOW	590
Omak, Wash.	KOMW	680
Oneida, N.Y.	WMCR	1600
Oneida, Tenn.	WBNT	1310
O'Neill, Nebr.	KBRX	1350
Oneonta, Ala.	WCRL	1570
Oneonta, N.Y.	WDOS	730
Ontario, Cal.	KSOM	1510
Ontario, Oreg.	KSRV	1380
Opelika, Ala.	WAOA	1520
	WPHO	1400
Opelousas, La.	KSLO	1230
Opp, Ala.	WAMI	860
Opportunity, Wash.	KZUN	630
Orange, Mass.	WCAT	1390
Orange, Tex.	KOGT	1600
Orange, Va.	WJMA	1340
Orangeburg, S.C.	WDIX	1150
	WORG	1580
	WTND	920
Orange Park, Fla.	WAYR	550
Ord, Neb.	KNLV	1060
Oregon City, Ore.	KYXI	1520
Orlando, Fla.	WDBO	580
	WHOO	990
	WORJ	1270
	WLOF	950
	WKIS	740
Orleans, Mass.	WVLC	1170
Ormond Beach, Fla.	WDAT	1380
Orofino, Idaho	KLER	950
Oroville, Calif.	KAOR	1340
Ortonville, Minn.	KDIO	1350
Osage Bch., Mo.	KRMS	1150
Osceola, Ark.	KOSE	860
Oshkosh, Wis.	WAGO	690
	WOSH	1490
Oskaloosa, Iowa	KBOE	740
Oswego, N.Y.	WSGO	1440
Othello, Wash.	KRSC	1400
Otsego, Mich.	WAOP	980
Ottawa, Ill.	WCMY	1430
Ottawa, Kans.	KOFO	1220
Ottumwa, Iowa	KBIZ	1240
	KLEE	1480
Owatonna, Minn.	KRFO	1390
Owego, N.Y.	WEBO	1330
Owensboro, Ky.	WOMI	1490
	WVJS	1420
Owosso, Mich.	WOAP	1080
Oxford, Miss.	WSUH	1420
Oxford, N.C.	WOXF	1340
Oxnard, Calif.	KOXR	910
Ozark, Ala.	WOZK	900
	WAYD	1190
Ozark, Ark.	KZRK	1540
Paducah, Ky.	WDXR	1560
	WKYX	570
	WPAD	1450
Page, Ariz.	KPGE	1340
Painesville, Ohio	WPVL	1460
Paintsville, Ky.	WSIP	1490
Palatka, Fla.	WWPF	1260
	WSUZ	800
Palestine, Tex.	KNET	1450
Palm Bch., Fla.	WQXT	1340
Palm Sprgs., Cal.	KCMJ	1010
	KDES	920
	KPAL	1450
Palmdale, Calif.	KUTY	1470
Palm Desert, Cal.	KGOL	1270
Palo Alto, Calif.	KIBE	1220
Pamona, Cal.	KWOW	1600
Pampa, Tex.	KPDN	1340
	KGRO	1230
Panama City Bch., Fla.	WGNE	1480
	WSCM	1290
Panama City, Fla.	WDLP	590
	WPCF	1430
Paoli, Ind.	WVAK	1560
Paradise, Cal.	KEWQ	930
Paragould, Ark.	KDRS	1490
Paris, Ark.	KCCL	1460
Paris, Ill.	WPRS	1440
Paris, Ky.	WPDE	1440
Paris, Tenn.	WTPR	710
Paris, Tex.	KPLT	1490
	KPRE	1250
Parkersburg, W. Va.	WCEF	1050
	WPAR	1450
	WTAP	1230
Park Falls, Wis.	WNBI	980
Park Rapids, Minn.	KPRM	1240
Parsippany-Troy Hills, N.J.	WPRC	1310
Parsons, Kans.	KLKC	1540
Pasadena, Cal.	KPPC	1240
	KRLA	1110

Location	C.L.	kHz
	KWKW	1300
Pasadena, Tex.	KLVL	1480
	KIKK	650
Pascagoula-Moss Point, Miss.	WPMP	1580
Pasco, Wash.	KORD	910
Paso Robles, Calif.	KPRL	1230
Pastillo, P.R.	WCGB	1050
Patchogue, L.I., N.Y.	WALK	1370
	WPAC	1580
Paterson, N.J.	WPAT	930
Pauls Valley, Okla.	KVLH	1470
Pawhuska, Okla.	KOSG	1500
Pawtucket, R.I.	WXTR	550
Payette, Ida.	KYET	1450
Pearsall, Tex.	KVWG	1280
Pecos, Tex.	KIUN	1400
Peekskill, N.Y.	WLNA	1420
Pekin, Ill.	WSIV	1140
Pell City, Ala.	WFHK	1430
Pendleton, Oreg.	KTIX	1240
	KUMA	1290
Pennington Gap, Va.	WSWV	1570
Pensacola, Fla.	WBOP	980
	WBSR	1450
	WMEL	610
	WNVY	1230
	WCOA	1370
	WPFA	790
Peoria, Ill.	WXCL	1350
	WMBD	1470
	WIRL	1290
	WPEO	1020
Perry, Fla.	WPRY	1400
	WGKR	1310
Perry, Ga.	WPGA	980
Perry, Iowa	KDLS	1310
Perryton, Tex.	KEYE	1400
Peru, Ind.	WARU	1600
Petaluma, Calif.	KTOB	1490
Peterborough, N.H.	WSCV	1050
Petersburg, Va.	WSSV	1240
Petosi, Mo.	KYRO	1280
Petoskey, Mich.	WMBN	1340
	WJML	1110
Philadelphia, Miss.	WHOC	1490
Philadelphia, Pa.	KYW	1060
	WCAU	1210
	WDAS	1480
	WFIL	560
	WFLN	900
	WHAT	1340
	WIBG	990
	WIP	610
	WPEN	950
	WRCP	1540
	WTEL	860
Philipsburg, Pa.	WPHB	1260
Philipsburg, Kans.	KKAN	1490
Phoenix, Ariz.	KIFN	860
	KASA	1540
	KCAC	1010
	KHAT	1480
	KHEP	1280
	KMEO	740
	KOY	550
	KOOL	960
	KPHO	910
	KRIZ	1230
	KTAR	620
	KXIV	1400
Pickens, S.C.	WKKR	1540
Piedmont, Ala.	WPID	1280
Piedmont, Mo.	KPWB	1140
Pierre, S.D.	KGFX	1060
	KCCR	1240
Pikeville, Ky.	WLSI	900
	WPKE	1240
Pine Bluff, Ark.	KCLA	1400
	KADL	1270
	KOTN	1490
	KCAT	1530
	KPBA	1590
Pine City, Minn.	WCMP	1350
Pinellas Park, Fla.	WFSO	570
Pineville, Ky.	WANO	1230
Pineville, Ky.	WMLF	1230
Pineville, W.Va.	WWYO	970
Pipestone, Minn.	KLOH	1050
Piqua, Ohio	WPTW	1570
Pittsburg, Calif.	KKIS	990
Pittsburg, Kans.	KOAM	860
	KSEK	1340
Pittsburgh, Pa.	KDKA	1020
	KQV	1410
	WAMO	860
	WIAS	1320
	WPIT	730
	WTAE	1250
	WEEP	1080
	WWSW	970
Pittsfield, Ill.	WBBA	1580
Pittsfield, Mass.	WBEC	1420
	WBRK	1340
Pittston, Pa.	WPTS	1540
Plainfield, N.J.	WERA	1590
Plainview, Tex.	KVOP	1400
Plant City, Fla.	WPLA	910
Platteville, Wis.	WSWW	1590
Plattsburg, N.Y.	WEAV	960
	WIRY	1340

Location	C.L.	kHz
	WKDR	1070
Pleasanton, Tex.	KBOP	1380
Pleasantville, N.J.	WOND	1400
Plymouth, Ind.	WTCA	1050
Plymouth, Mass.	WPLM	1390
Plymouth, N.C.	WPNC	1470
Plymouth, N.H.	WPNH	1300
Plymouth, Wis.	WPLY	1420
Pocahontas, Ark.	KPOC	1420
Pocatello, Idaho	KSEI	930
	KWIK	1240
	KSNN	1290
Pocomoke City, Md.	WDMV	540
Pomona, Calif.	KWOW	1600
	KKAR	1220
Pompton, Lakes, N. J.	WKER	1500
Pompano Beach, Fla.	WLOD	980
	WRBD	1470
Ponca, City, Okla.	WBBZ	1230
Ponce, P.R.	WPRP	910
	WEUC	1420
	WPAB	550
	WLEO	1170
	WISO	1260
Pontiac, Ill.	WPOK	1080
Pontiac, Mich.	WPON	1460
Pontotoc, Miss.	WSEL	1440
Pooli, Ind.	WVAK	1560
Poplar Bluff, Mo.	KWOC	930
	KLID	1340
Poplarville, Miss.	WRPM	1530
Portage, Mich.	WTPS	1560
Portage, Pa.	WWML	1470
Portage, Wis.	WPDR	1350
Portageville, Mo.	KMIS	1050
Portales, N.Mex.	KENM	1450
Port Angeles, Wash.	KAPY	1000
	KONP	1450
Port Arthur, Tex.	KOLE	1340
	KPAC	1250
	KCAW	1510
Porterville, Calif.	KTIP	1450
Port Hueneme, Calif.	KACY	1520
Port Huron, Mich.	WHLS	1450
	WPHM	1380
Port Jervis, N.Y.	WDLC	1490
Port Lavaca, Tex.	KGUL	1560
Portland, Ind.	WPGW	1440
Portland, Maine	WCSH	970
	WGAN	560
	WLOB	1310
	WPOR	1490
Portland, Oreg.	KBPS	1450
	KLIQ	1290
	KEX	1190
	KGW	620
	KKEY	1150
	KOIN	970
	KPAM	1410
	KPDQ	800
	KPOJ	1330
	KWJJ	1080
	KXL	750
Port Neches, Tex.	KPNG	1150
Port St. Joe, Fla.	WJOE	1080
Portsmouth, N.H.	WBBX	1380
	WHEB	750
Portsmouth, Ohio	WPAY	1400
	WNXT	1260
Portsmouth, Va.	WHIH	1400
	WCVU	1350
	WPMH	1010
Port Sulphur, La.	KPBC	1510
Port Washington, Wis.	WGLB	1560
Post, Tex.	KPOS	1370
Poteau, Okla.	KLCO	1280
Potomac-Cabin John, Md.	WXLN	950
Potosi, Mo.	KYRO	1280
Potsdam, N.Y.	WPDM	1470
Pottstown, Pa.	WPAZ	1370
Pottsville, Pa.	WPAM	1450
	WPPA	1360
Poughkeepsie, N.Y.	WEOK	1390
	WKIP	1450
Powell, Wyo.	KPOW	1260
Poynette, Wis.	WIBU	1240
Praire du Chien, Wis.	WPRE	980
Pratt, Kan.	KWNS	1290
Prattville, Ala.	WPXC	1410
Prentiss, Miss.	WKPO	1510
Prescott, Ariz.	KYCA	1490
	KENT	1340
	KNOT	1450
Prescott, Ark.	KTPA	1370
Presque, Isle, Me.	WAGM	950
	WEGP	1390
Preston, Idaho	KPST	1340
Preston, Minn.	KFIL	1060
Prestonsburg, Ky.	WPRT	960
	WDOC	1310
Price, Utah	KOAL	1230
Prichard, Ala.	WZAM	1270
Prince Albert, Sask.	CKBI	900
Princeton, Ill.	WZOE	1490
Princeton, Ind.	WRAY	1250
Princeton, Ky.	WPKY	1580
Princeton, Minn.	WKPM	1300
Princeton, N.J.	WHWH	1350
Princeton, W.Va.	WLOH	1490

Location	C.L.	kHz
Prineville, Oreg.	KRCO	690
Prosser, Wash.	KARY	1310
Providence, R.I.	WEAN	790
	WHIM	1110
	WICE	1290
	WJAR	920
	WLKW	990
	WPRO	630
	WRIB	1220
Provo, Utah	KIXX	1400
	KEYY	1450
	KOVO	960
Pryor, Okla.	KOLS	1570
Pueblo, Colo.	KDZA	1230
	KAPI	690
	KCSJ	590
	KFEL	970
Pueblo, Colo.	KKAM	1350
	KPUB	1480
Pulaski, Tenn.	WKSR	1420
Pulaski, Va.	WPUV	1580
Pullman, Wash.	KWSU	1250
	KPUL	1150
Punta Gorda, Fla.	WCCF	1580
Punxsutawney, Pa.	WFME	1540
Putnam, Conn.	WINY	1350
Puyallup, Wash.	KAYE	1450
Quanah, Tex.	KOLJ	1150
Quantico, Va.	WQVA	1580
Quincy, Cal.	KPCO	1370
Quincy, Fla.	WCNH	1230
Quincy, Ill.	WGEM	1440
	WTAD	930
Quincy, Mass.	WJDA	1300
Quincy, Wash.	KPOR	1370
Quitman, Ga.	WSFB	1490
Quitman, Miss.	WBFN	1500
Racine, Wis.	WRAC	1460
	WRJN	1400
Radford, Va.	WRAD	1460
Raeford, N.C.	WSHB	1400
Rainsville, Ala.	WSVM	1500
Raleigh, N.C.	WKIX	850
	WYNA	1550
	WPTF	680
	WLLE	570
	WRNC	1240
Ralls, Tex.	KCLR	1530
Rantoul, Ill.	WRTL	1460
Randolph, Vt.	WCVR	1230
Rapid City, S.Dak.	KOTA	1380
	KIMM	1150
	KRSD	1340
	KEZU	920
Raton, N.Mex.	KRTN	1490
Ravenswood, W.Va.	WMOV	1360
Rawlins, Wyo.	KRAL	1240
Raymond, Wash.	KAPA	1340
Raymondville, Tex.	KSOX	1240
Rayville, La.	KRIH	990
Reading, Pa.	WEEU	850
	WHUM	1240
	WRAW	1340
Red Bay, Ala.	WRMG	1430
Redding, Calif.	KRDG	1230
	KCLM	1330
	KQMS	1400
	KVCV	600
	KVIP	540
Red Bluff, Calif.	KBLF	1490
Redfield, S.Dak.	KFCB	1380
Redlands, Calif.	KCAL	1410
Red Lion, Pa.	WGCB	1440
Red Lodge, Mont.	KRBN	1450
Redmond, Oreg.	KPRB	1240
Red Oak, Id.	KOAK	1080
Red Springs, N.C.	WYRU	1510
Red Wing, Minn.	KCUE	1250
Redwood Falls, Mi.	KLGR	1490
Reedsburg, Wis.	WRDB	1400
Reedsport, Ore.	KDUN	1470
Reidsville, N.C.	WFRC	1600
	WREV	1220
Remsen, N.Y.	WADR	1480
Reno, Nev.	KOH	630
	KBET	1340
	KCRL	780
	KOBY	1550
	KOLO	920
	KONE	1450
	KCBN	1230
Rensselaer, Ind.	WRIN	1560
Rensselaer, N.Y.	WEEE	1300
Renton, Wash.	KREN	1420
Rexburg, Idaho	KRXK	1230
Rhinelander, Wis.	WOBT	1240
Rice Lake, Wis.	WJMC	1240
Richfield, Minn.	WPPB	980
Richfield, Utah	KSVC	980
Richland, Wash.	KALE	960
Richland Center, Wis.	WRCO	1450
Richlands, Va.	WRIC	540
Richmond, Ind.	WKBV	1490
Richmond, Ky.	WEKY	1340
	WCBR	1110
Richmond, Va.	WANT	990
	WBBL	1480
	WRGM	1540
	WLEE	1480
	WEET	1320
	WGOE	1590
	WTVR	1380
	WRNL	910

Location	C.L.	kHz
	WRVA	1140
	WXGI	950
	WRGM	1540
Richwood, W.Va.	WVAR	600
Ridgecrest, Cal.	KLOA	1240
Ridgeland, S.C.	WBUG	1430
Rifle, Colo.	KWSR	810
Rio Piedras, P.R.	WUNO	1320
Ripley, Miss.	WSCA	1260
Ripley, Tenn.	WTRB	1570
Ripon, Wis.	WCWC	1600
River Falls, Wis.	WEVR	1550
Riverhead, N.Y.	WRIV	1390
	WHRF	1570
Riverside, Calif.	KPRO	1440
	KACE	1570
Riverton, Wyo.	KVOW	1450
Riviera Beach, Fla.	WXVI	1600
Roanoke, Ala.	WELR	1360
Roanoke, Va.	WFIR	960
	WRIS	1410
	WTOY	910
	WROV	1240
	WSLS	610
Roanoke Rapids, N.C.	WCBT	1230
Roaring Springs, Pa.	WKMC	1370
Roberval, Que.	CHRL	910
Robinson, Ill.	WTAY	1570
Robstown, Tex.	KROB	500
Rochelle, Ill.	WRHL	1060
Rochester, Minn.	KROC	1340
	KWEB	1270
	KOLM	1520
Rochester, N.H.	WWNH	930
Rochester, N.Y.	WBBF	950
	WHAM	1180
	WHEC	1460
	WNYR	680
	WSAY	1370
	WROC	1280
Rockford, Ill.	WROK	1440
	WYFE	1150
	WRRR	1330
Rockford, Mich.	WJPW	810
Rock Hills, S.C.	WRHI	1340
	WTYC	1150
Rockingham, N.C.	WAYN	900
	WLWL	1500
Rock Island, Ill.	WHBF	1270
Rockland, Maine	WRKD	1450
Rockmart, Ga.	WPLK	1220
Rock Springs, Wyo.	KVRS	1380
Rockville, Conn.	WRNY	800
Rockville, Md.	WINX	1600
Rockwood, Tenn.	WRKH	580
Rocky Ford, Colo.	KAVI	1320
Rocky Mount, N.C.	WCEC	810
	WEED	1390
	WRMT	1490
	WKWS	1290
Rocky Mount, Va.	WYTI	1570
Rogers, Ark.	KAMO	1390
Rogers City, Mich.	WHAK	960
Rogersville, Tenn.	WRGS	1370
Rolla, Mo.	KCLU	1590
	KTTR	1490
Rome, Ga.	WLAQ	1410
	WIYN	1360
	WRGA	1470
	WROM	710
Rome, N.Y.	WKAL	1450
	WRNY	1350
Roneeverte, W.Va.	WRON	1400
Roseau, Minn.	KRWB	1410
Rosehurg, Oreg.	KRNR	1490
	KQEN	1240
	KRXL	1250
	KYES	950
Rosenberg, Tex.	KFRD	980
Roservelt, N.M.	KRDD	1320
Roseville, Cal.	KPOP	1110
Rossville, Ga.	WRIP	980
Roswell, N.Mex.	KRSY	1230
	KKAT	1430
	KBIM	910
	KSWS	1020
Roxboro, N.C.	WRXO	1430
Royal Oak, Mich.	WEXL	1340
Rugby, N.Dak.	KGCA	1450
Ruidoso, N.Mex.	KRRR	1340
Rumford, Me.	WRUM	790
Rupert, Idaho	KAYT	970
Rushton, La.	KRUS	1490
Rusk, Texas	KTLU	1580
Russell, Kans.	KRSL	990
Russellville, Ala.	WWWR	920
Russellville, Ark.	KARV	1490
Russellville, Ky.	WRUS	610
Rutland, Vt.	WHWB	1000
	WSYB	1380
Rutherfordton, N.C.	WCAB	590
Sacramento, Calif.	KCRA	1320
	KFBK	1530
	KGMS	1380
	KJAY	1430
	KRAK	1140
	KROY	1240
	KXOA	1470
Safford, Ariz.	KGLU	1480
	KATO	1230
Sag Harbor, N.Y.	WLNG	1600

WHITE'S RADIO LOG

Location	C.L.	kHz
Saginaw, Mich.	WKNX	1210
	WSAM	1400
	WSGW	790
St. Albans, Vt.	WWSR	1420
St. Albans, W.Va.	WKLC	1300
St. Anthony, Ida.	KIGO	1400
St. Augustine, Fla.	WFOY	1240
	WETH	1420
St. Charles, Mo.	KIRL	1460
St. Cloud, Minn.	KFAM	1450
	WJON	1240
St. George, S.C.	WQIZ	810
St. George, Utah	KDXU	1430
St. Helen, Mich.	WMIC	1590
St. Helens, Oreg.	KOHI	1600
St. Ignace, Mich.	WIDG	940
St. Johns, Mich.	WRBJ	1580
St. Johnsbury, Vt.	WTWN	1340
St. Joseph, Mich.	WSJM	1400
St. Joseph-Benton Harbor, Mich.	WHFB	1060
St. Joseph, Mo.	KFEQ	680
	KKJO	1550
	KUSN	1270
St. Louis, Mo.	KATZ	1600
	KMOX	1120
	KSD	550
	KTSL	890
	KWK	1380
	KXOK	630
	WEW	770
	WIL	1430
	KXEN	1010
St. Louis Park, Minn.	KRSI	950
St. Maries, Idaho	KOFE	1480
St. Mary's, Pa.	WKBI	1400
St. Paul, Minn.	KSTP	1500
	DKWB	630
	WMIN	1400
	WMKT	1370
	WCCO	830
St. Pauls, N.C.	WBYB	1060
St. Peter, Minn.	KRBI	1310
St. Petersburg, Fla.	WWBA	680
	WSUN	620
	WLCY	1380
St. Petersburg Beach, Fla.	WILZ	1590
Salamanca, N.Y.	WGGO	1590
Salem, Ill.	WJBD	1350
Salem, Ind.	WSLM	1220
Salem, Mass.	WESX	1230
Salem, Mo.	KSMO	1340
Salem, N.J.	WJIC	1510
Salem, O.	WSOM	600
Salem, Oreg.	KSLM	1390
	KAPT	1220
	KBZY	1490
	KGAY	1480
Salem, Va.	WBLU	1480
Salida, Colo.	KVRH	1340
Salina, Kans.	KSAL	1150
	KFRM	550
	KLSI	910
Salinas, Calif.	KDON	1460
	KTOM	1380
	KRSA	1570
	KCTY 980-1000	
Salinas, P.R.	WHOY	1210
Saline, Mich.	WOIB	1290
Salisbury, Md.	WBOC	960
	WICO	1320
	WJDY	1470
Salisbury, N.C.	WSTP	1490
	WSAT	1280
Sallisaw, Okla.	KBJS	1510
Salmon, Idaho	KSRA	960
Salt Lake City, Utah	KALL	910
	KCPX	1320
	KLUB	570
	KNAK	1280
	KRGO	1550
	KRSP	1060
	KSL	1160
	KSOP	1370
	KSXX	630
	KWHO	860
San Angelo, Tex.	KTEO	1340
	KGKL	960
	KPEP	1420
	KWFR	1260
San Antonio, Tex.	KAPE	1480
	KBAT	680
	KBER	1150
	KBUC	1310
	KCOR	1350
	KEDA	1540
	KUKA	1250
	KMAC	630
	KONO	860
	KTSA	550
	WOAI	1200
San Bernardino, Calif.	KCKC	1350
	KFXM	590
	KRNO	1240
	KMEN	1290
Sandersville, Ga.	WSNT	1490
San Diego, Calif.	KCBQ	1170
	KFMB	760
	KOGO	600
	KGB	1360
	KSON	1240
	KSDO	1130
Sandpoint, Idaho	KSPT	1400
Sand Spring, Okla.	KTOW	1340
Sandusky, Mich.	WMIC	1560
Sandusky, Ohio	WLEC	1450
San Fernando, Calif.	KGIL	1260
Sanford, Fla.	WTRR	1400
	WSFR	1300
Sanford, Me.	WSME	1220
Sanford, N.C.	WEYE	1290
	WWGP	1050
San Francisco, Calif.	KFRC	610
	KCBS	740
	KFAX	1100
	KGO	810
	KNBR	680
	KKHI	1550
	KSAY	1010
	KSFO	560
	KSOL	1450
	KYA	1260
San Gabriel, Cal.	KALI	1430
San German, P.R.	WRJS	1060
Sanitobia, Miss.	WSAQ	1550
San Jose, Calif.	KLOK	1170
	KLIV	1590
	KEEN	1370
	KXRX	1500
San Juan, P.R.	WAPA	680
	WBMJ	1190
	WHOA	870
	WIAC	740
	WIPR	940
	WITA	1140
	WKAQ	580
	WKVM	810
	WQBS	650
	WRAI	1520
San Luis Obispo, Calif.	KATY	1340
	KSLY	1400
	KVEC	920
San Marcos, Tex.	KCNY	1470
San Mateo, Calif.	KOFY	1050
San Rafael, Calif.	KTIM	1510
San Saba, Tex.	KBAL	1410
San Sebastion, P.R.	WFBA	1460
Santa Ana, Calif.	KWIZ	1480
Santa Barbara, Cal.	KDB	1490
	KGUD	990
	KIST	1340
	KTMS	1250
	KACL	1290
Santa Clara, Cal.	KEGL	1430
Santa Cruz, Calif.	KSCO	1080
Sante Fe, N.Mex.	KTRC	1400
	KAFE	810
	KVSF	1260
Santa Maria, Cal.	KUHL	1440
	KSMA	1240
	KSEE	1480
	KZON	1600
Santa Monica, Cal.	KDAY	1580
Santa Paula, Cal.	KQIQ	1400
Santa Rosa, Calif.	KSRO	1350
	KVRE	1460
	KJAX	1150
Santa Rosa, N.Mex.	KSYX	1420
Sapulpa, Okla.	KRMG	1550
Saranae Lake, N.Y.	WNBZ	1240
Sarasota, Fla.	WKXY	930
	WSAF	1220
	WSPB	1450
	WYND	1280
Saratoga, N.Y.	WSPN	900
Saratoga Springs, N.Y.	WKAJ	900
Sauk Rapids, Minn.	WVAL	800
Sault Ste. Marie, Mich.	WSOO	1230
Savannah, Ga.	WBYG	1450
	WEAS	900
	WSAV	630
	WSGA	1400
	WTOC	1290
	WSOK	1230
Savannah, Tenn.	WORM	1010
Sayre, Pa.	WATS	960
Scheffield, Ala.	WSHF	1290
Schenectady, N.Y.	WGY	810
	WSNY	1240
Scotland Neck, N.C.	WYAL	1280
Scott City, Kans.	KFLA	1310
Scottsbluff, Nebr.	KNEB	960
	KOLT	1320
Scottsboro, Ala.	WCRI	1050
	WROS	1330
Scottsdale, Ariz.	KDOT	1440
Scottsville, Ky.	WLCK	1250
Scranton, Pa.	WARM	590
	WEJL	630
	WGBI	910
	WICK	1400
	WSCR	1320
Seaford, Del.	WSUX	1280
Searcy, Ark.	KWCB	1300
Seaside, Ore.	KSWB	930
Seattle, Wash.	KAYO	1150
	KIXI	910
	KING	1090
	KIRO	710
	KJR	950
	KOL	1300
	KOMO	1000
	KSND	1590
	KTW	1250
	KVI	570
	KXA	770
	KBLE	1050
Sebring, Fla.	WJCM	960
	WSEB	1340
Sedalia, Mo.	KDRO	1490
	KSIS	1050
Seguin, Tex.	KWED	1580
Selinsgrove, Pa.	WSEW	1240
Selma, Ala.	WAMA	1340
	WHBB	1490
	WTQX	1570
Selma, N.C.	WBZB	1090
Selmer, Tenn.	WDTM	1130
Seminole, Tex.	KIKZ	1250
Senatobia, Miss.	WSAO	1550
Seneca Falls, N.Y.	WSFW	1110
Seneca Township, S.C.	WSNW	1150
Sevierville, Tenn.	WSEV	930
Seymour, Ind.	WJCD	1390
Seymour, Tex.	KSEY	1230
Shakopee, Minn.	KSMM	1530
Shallotte, N.C.	WVCB	1410
Shamokin, Pa.	WISL	1480
Shamrock, Tex.	KBYP	1580
Sharon, Pa.	WPIC	790
Shawano, Wis.	WTCH	960
Shawnee, Okla.	KGFF	1450
Sheboygan, Wis.	WHBL	1330
	WKTS	950
Sheffield, Ala.	WSHF	1290
Shelby, Mont.	KSEN	1150
Shelby, N.C.	WOHS	730
	WADA	1390
Shelbyville, Ind.	WSVL	1520
Shelbyville, Ky.	WCND	1340
Shelbyville, Tenn.	WHAL	1400
	WLIJ	1580
Sheldon, Iowa	KIWA	1550
Shell Lake, Wis.	WCSW	940
Shelton, Wash.	KMAS	1280
Shenandoah, Iowa	KMA	960
Shenandoah, Pa.	WMBT	1530
Sheridan, Wyo.	KWYO	1410
	KROE	930
Sherman, Tex.	KRRV	910
	KXTO	1500
Shippensburg, Pa.	WSHP	1480
Show Low, Ariz.	KVSL	1590
	KVWM	970
Shreveport, La.	KBCL	1220
	KEEL	710
	KOKA	1550
	KJOE	1480
	KCIJ	980
	KRMD	1340
	KWKH	1130
Sidney, Mont.	KGCX	1480
Sidney, Nebr.	KSID	1340
Sidney, O.	WMVR	1080
Sierra Vista, Ariz.	KHFH	1420
Sikeston, Mo.	KSIM	1400
	KMPL	1520
Siler City, N.C.	WNCA	1570
Siloam Sprgs., Ark.	KUOA	1290
Silsbee, Tex.	KKAS	1300
Silver City, N.Mex.	KSIL	1340
Silver Sprgs., Md.	WQMR	1050
Simcoe, Ont.	CFRS	1560
Sinton, Tex.	KTOD	1590
Sioux Center, Iowa	KVDB	1090
Sioux City, Iowa	KSCJ	1360
	KMNS	620
	KTRI	1470
Sioux Falls, S.Dak.	KISD	1230
	KELO	1320
	KNWC	1270
	KSOO	1140
	KXRB	1520
Sitka, Alaska	KIFW	1230
	KSEW	1400
Skowhegan, Maine	WGHM	1150
Slaton, Tex.	KCAS	1050
Slidell, La.	WBGS	1560
Smithfield, N.C.	WMPM	1270
Smithville, Tenn.	WJLE	1480
Smyrna, Ga.	WYNX	1550
Snyder, Tex.	KSNY	1450
Socorro, N.Mex.	KSRC	1290
Soda Springs, Ida.	KBRV	790
Soldatna, Alaska	KSRM	920
Somerset, Ky.	WSFC	1240
	WTLO	1480
Somerset, Pa.	WVSC	990
Soddy, Tenn.	WEDG	1240
Sonora, Calif.	KVML	1450
So. Beloit, Ill.	WBEL	1380
So. Bend, Ind.	WNDU	1490
	WJVA	1580
	WSBT	960
Southbridge, Mass.	WESO	970
So. Boston, Va.	WHLF	1400
Southern Pines, N.C.	WEEB	990
South Charleston, W. Va.	WRDS	1410
S. Daytona, Fla.	WELE	1590
So. Gastonia, N.C.	WGAS	1420
So. Haven, Mich.	WJOR	940
South Hill, Va.	WJWS	1370
Southington, Conn.	WNTY	990
So. Knoxville, Tenn.	WSKT	1580
South Lake Tahoe, Cal.	KOWL	1490
	KTHO	590
S. Miami, Fla.	WFUN	790
So. Paris, Me.	WKTQ	1450
So. Pittsburg, Tenn.	WEPG	910
So. St. Paul, Minn.	KDWB	630
	WMKT	1370
So. Williamsport, Pa.	WMPT	1450
Spanish Fork, Utah	KONI	1480
Sparks, Nev.	KBUB	1270
Sparta, Ill.	WHCO	1230
Sparta, N.C.	WCOK	1060
Sparta, Tenn.	WSMT	1050
Sparta, Wis.	WKLJ	990
	WCOW	1290
Spartanburg, S.C.	WHCQ	1400
	WORD	910
	WSPA	950
	WASC	1530
Spencer, Iowa	KICD	1240
Spencer, W.Va.	WVRC	1400
Spokane, Wash.	KGA	1510
	KDNC	1440
	KSPO	1230
	KPEG	1380
	KHQ	590
	KJRB	790
	KREM	970
	KXLY	920
	KCFA	1330
	KUDY	1280
Springdale, Ark.	KBRS	1340
	KSPR	1590
Springfield, Ill.	WCVS	1450
	WMAY	970
	WTAX	1240
Springfield, Mass.	WHYN	560
	WMAS	1450
	WSPR	1270
Springfield, Mo.	KGBX	1260
	KICK	1340
	KTTS	1400
	KWTO	560
Springfield, Ohio	WIZE	1340
	WBLY	1600
Springfield, Ore.	KCNW	1120
Springfield-Eugene, Ore.	KEED	1450
	KORE	1050
Springfield, Tenn.	WDBL	1590
Springfield, Vt.	WCFR	1480
Springhill, La.	KBSF	1480
Spring Lake, N.C.	WFBS	1450
Spring Valley, N.Y.	WKQW	1300
Spruce Pine, N.C.	WTOE	1470
Stamford, Conn.	WSTC	1400
Stamford, Tex.	KDWT	1400
Stanford, Ky.	WRSL	1520
Starke, Fla.	WPXE	1490
Starkville, Miss.	WKOR	980
	WSSO	1230
State College, Pa.	WMAJ	1450
	WRSC	1390
Statesboro, Ga.	WWNS	1240
Statesville, N.C.	WSIC	1400
	WDBM	550
Staunton, Va.	WTON	1240
	WAFC	900
Stephenville, Tex.	KSTV	1510
Sterling, Colo.	KGEK	1230
Sterling, Ill.	WSDR	1240
Steubenville, Ohio	WSTV	1340
Stevens Point, Wis.	WSPT	1010
Stillwater, Minn.	WAVN	1220
Stillwater, Okla.	KSPI	780
Stockton, Calif.	KJOY	1280
	KSTN	1420
	KWG	1230
Storm Lake, Iowa	KAYL	990
Streator, Ill.	WIZZ	1250
Stroudsburg, Pa.	WVPO	840
Stuart, Fla.	WSTU	1450
Stuart, Va.	WHEO	1270
Sturgeon Bay, Wis.	WDOR	910
Sturgis, Mich.	WSTR	1230
Sturgis, S.D.	KBHB	810
Stuttgart, Ark.	KWAK	1240
Suffolk, Va.	WLPM	1450
Sullivan, Ind.	WKQV	1550
Sullivan, Mo.	KTUI	1560
Sulphur, La.	KIKS	1310
Sulphur Sprgs., Tex.	KSST	1230

Location	C.L.	kHz
Summerville, Ga.	WGTA	950
Summerville, S.C.	WAZS	980
Sumner, Wash.	KDFL	1560
Sumter, S.C.	WFIG	1290
	WDXY	1240
	WSSC	1340
Sunbury, Pa.	WKOK	1070
Sunnyside, Wash.	KREW	1230
Superior, Nebr.	KRFS	1600
Superior, Wis.	WDSM	710
	WAKX	1320
	WWJC	1270
	WAXK	1320
Susanville, Calif.	KSUE	1240
Sutton, W.Va.	WSGB	1490
Swainsboro, Ga.	WJAT	800
Sweet Home, Ore.	KFIR	1370
Sweetwater, Tenn.	WDEH	800
Sweetwater, Tex.	KXOX	1240
Sylacauga, Ala.	WFEB	1340
	WMLS	1290
	WMSJ	1480
Sylva, N.C.	WSYL	1490
Sylvania, Ga.	WOGA	1540
Sylvester, Ga.	WHEN	620
Syracuse, N.Y.	WFBL	1390
	WNDR	1260
	WOLF	1490
	WSYR	570
Tabor City, N.C.	WTAB	1370
Tacoma, Wash.	KMO	1360
	KTAC	850
	KTNT	1400
	KVI	570
Taft, Calif.	KTKR	1310
Tahlequah, Okla.	KTLQ	1350
Tahoe Valley, Calif.	KTHO	590
Talladega, Ala.	WEYY	1580
	WNUZ	1230
Tallahassee, Fla.	WMEN	1330
	WONS	1410
	WTAL	1450
	WTNT	1270
Tallassee, Ala.	WTLS	1300
Tallulah, La.	KTLD	1360
Tampa, Fla.	WALT	1110
	WDAE	1250
	WYOU	1550
	WFLA	970
	WHBO	1050
	WINQ	1010
	WTMP	1150
	WSOL	1300
Taos, N. Mex.	KKIT	1340
Tarboro, N.C.	WCPS	760
Tasley, Va.	WESR	1330
Taunton, Mass.	WPEP	1570
Tawas City, Mich.	WIOS	1480
Taylor, Tex.	KTAE	1260
Taylorsville, Miss	WSCO	1280
Taylorsville, N. C.	WSTH	860
	WTLK	1570
Taylorville, Ill.	WTIM	1410
Tazewell, Tenn.	WNTT	1250
Tazewell, Va.	WTZE	1470
Tell City, Ind.	WTCJ	1290
Tempe, Ariz.	KUPD	1060
	KTUF	1580
Temple, Tex.	KTEM	1430
Terre Haute, Ind.	WBOW	1230
	WAAC	1300
	WTHI	1480
Terrell, Tex.	KTER	1570
Terrell Hills, Tex.	KITE	930
Terrytown, Nebr.	KEYR	690
Texarkana, Ark.	KOSY	790
	KTFS	1400
Texarkana, Tex.	KCMC	740
	KATQ	940
Texas City, Tex.	KTLW	920
Thayer, Mo.	KALM	1290
The Dalles, Oreg.	KODL	1440
	KACI	1300
Thermopolis, Wyo.	KRTR	1490
	KTHE	1240
Thief River Falls, Minn.	KTRF	1230
Thibodaux, La.	KTIB	630
Thomaston, Ga.	WSFT	1220
	WTGA	1590
	WTHN	1500
Thomasville, Ala.	WJDB	630
Thomasville, Ga.	WPAX	1240
	WLDR	730
Thomasville, N.C.	WTNC	790
Thomson, Ga.	WTWA	1240
Three Rivers, Mich.	WKLM	1510
Thurmont, Md.	WTHU	1450
Ticonderoga, N.Y.	WIPS	1250
Tiffin, Ohio	WTTF	1600
Tifton, Ga.	WTIF	1340
	WWGS	1430
Tillamook, Oreg.	KTIL	1590
Tioga, N.D.	KTGO	1090
Titusville, Fla.	WRMF	1050
Titusville, Pa.	WTIV	1230
Toccoa, Ga.	WLET	1420
	WNES	630
Toledo, Ohio	WOHO	1470
	WSPD	1370
	WTOD	1560
	WCWA	1230
	WTTO	1520
Toledo, Oreg.	KTDO	1230
Tolleson, Ariz.	KRDS	1190
Tomah, Wis.	WTMB	1460
Tomahawk, Wis.	WELF	810
Thompkinsville, Ky.	WTKY	1370
Tooele, Utah	KDYL	990
Topeka, Kans.	WIBW	580
	KEWI	1440
	WREN	1250
	KTOP	1490
Toppenish, Wash.	KENE	1490
Torrington, Conn.	WTOR	610
Torrington, Wyo.	KGOS	1490
Towanda, Pa.	WTTC	1550
Towson, Md.	WTOW	1570
Trail, B.C.	CJAT	610
Travelers Rest, S.C.	WBBR	1580
Traverse City, Mich.	WTCM	1400
	WCCW	1310
Trenton, Mo.	KTTN	1600
Trenton, N.J.	WAAT	1300
	WBUD	1260
	WTTM	920
Trenton, Tenn.	WTNE	1500
Trinidad, Colo.	KCRT	1240
Troy, Ala.	WTBF	970
Troy, N.Y.	WHAZ	1330
	WTRY	980
	WXKW	1600
Troy, N. C.	WJRM	1390
Truckee, Cal.	KTRT	1400
Trumann, Ark.	KTMN	1530
Truth or Consequences, New Mexico	KCHS	1400
Tryon, N.C.	WTYN	1550
Tuscon, Ariz.	KTUC	1400
	KXEW	1600
	KAIR	1490
	KCEE	790
	KIKX	580
	KCUB	1290
	KEVT	690
	KHOS	940
	KHYT	1330
	KTKT	990
	KOPO	1450
	KUAT	1550
Tucumcari, N.Mex.	KTNM	1400
Tulare, Calif.	KCOK	1270
	KGEN	1370
Tulia, Tex.	KTUE	1260
Tullahoma, Tenn.	WJIG	740
Tulsa, Okla.	KAKC	970
	KCNW	1300
	KRMG	740
	KELI	1430
	KVOO	1170
	KFMJ	1050
Tupelo, Miss.	WELO	580
	WTUP	1490
Turlock, Calif.	KCEY	1390
Tuscaloosa, Ala.	WJRD	1150
	WACT	1420
	WNPT	1280
	WTUG	790
	WTBC	1230
Tuscumbia, Ala.	WVNA	1590
	WRCK	1410
Tuskegee, Ala.	WABT	580
Twenty-Nine Palms, Calif.	KDHI	1250
Twin Falls, Idaho	KTFI	1270
	KLIX	1310
	KEEP	1450
Two Rivers, Wis.	WQTC	1590
Tyler, Tex.	KZAK	1330
	KDOK	1490
	KTBB	600
	KZEY	690
Tylertown, Miss.	WTYL	1290
Tyrone, Pa.	WTRN	1340
Uhrichsville, O.	WBTC	1540
Uklah, Cal.	KMSL	1250
Ulysses, Kan.	KULY	1420
Union, Mo.	KLPW	1220
Union, S.C.	WBCU	1460
Union City, Tenn.	WENK	1240
Uniontown, Pa.	WMBS	590
Urbana, Ill.	WILL	580
	WCCR	1580
Utica, N.Y.	WIBX	950
	WBVM	1550
	WRUN	1150
	WTLB	1310
Utuado, P.R.	WUPR	1530
Uvalde, Tex.	KVOU	1400
Valdese, N.C.	WSVM	1490
Valdosta, Ga.	WGOV	950
	WGAF	910
	WJEM	1150
	WVLD	1450
Valentine, Nebr.	KVSH	940
Vallejo, Calif.	KNBA	1190
Valley City, N.Dak.	KOVC	1490
Valparaiso, Fla.	WFSH	1340
Valparaiso, Ind.	WAKE	1500
	WNWI	1080
Van Buren, Ark.	KFDF	1580
Van Cleve, Ky.	WMTC	730
Vanceburg, Ky.	WKKS	1570
Vancouver, Wash.	KISN	910
	KKEY	1150
	KGAR	1550
	KVAN	1480
Vandalia, Ill.	WPMB	1500
Van Wert, Ohio	WERT	1220
Venice, Fla.	WAMR	1320
Ventura, Calif.	KVEN	1450
	KUSU	1590
Vermillion, S.Dak.	KUSD	690
	KVRA	1570
Vernal, Utah	KVEL	920
Vernon, Ala.	WVSA	1380
Vernon, Tex.	KVWC	1490
Vero Beach, Fla.	WAXE	1370
	WTTB	1490
Vicksburg, Miss.	WQBC	1420
	WVIM	1490
Victoria, Tex.	KNAL	1410
	KVIC	1340
Victorville, Calif.	KCIN	1590
Vidalia, Ga.	WVOP	970
Vidalia, Ga.	WVOP	970
Vieques, P.R.	WIVV	1370
Ville Platte, La.	KVPI	1050
Vincennes, Ind.	WAOV	1450
Vineland, N.J.	WWBZ	1360
	WDVL	1270
Vinita, Okla.	KVIN	1470
Vinton, Va.	WKBA	1550
Virginia, Minn.	WHLB	1400
Virginia Beach, Va.	WVAB	1550
Virouqua, Wis.	WISV	1360
Visalia, Calif.	KONG	1400
Vista, Cal.	KMLO	1000
Vivian, La.	KNCB	1600
Waco, Tex.	WACO	1460
	KAWA	1010
	KWTX	1230
Wadena, Minn.	KWAD	920
Wadesboro, N.C.	WADE	1210
Wagoner, Okla.	KWLG	1530
Wailuku, Hawaii	KMVI	550
Waipahu, Hawaii	KAHU	940
Walhalla, S.C.	WGOG	1000
Wallace, N.C.	WLSE	1400
Walla Walla, Wash.	KHIT	1320
	KUJ	1420
	KTEL	1490
Walnut Ridge, Ark.	KRLW	1320
Walsenburg, Colo.	KFLJ	1360
Walterboro, S.C.	WALD	1220
Waltham, Mass.	WCRB	1330
Walton, N.Y.	WDLA	1270
Wanchese, N.C.	WOBR	1530
Ware, Mass.	WARE	1250
Warner Robbins, Ga.	WRBN	1600
	WAVC	1350
Warren, Ark.	KWRF	1050
Warren, Ohio	WHHH	1440
	WDNL	1570
Warren, Pa.	WNAE	1310
Warrensburg, Mo.	KOKO	1450
Warrenton, Mo.	KWRE	730
Warrenton, Va.	WEER	1250
	WKCW	1420
Warsaw, Ind.	WRSW	1480
Warsaw, Va.	WNNT	690
Warwick, N.Y.	WIBQ	1110
Warwick-E. Greenwich, R.I.	WARV	1590
	KWSO	1050
Washington, D.C.	WMAL	630
	WOL	1450
	WOOK	1340
	WWDC	1260
	WRC	980
	WTOP	1500
Washington, Ga.	WLOV	1370
Washington, Ind.	WAMW	1580
Washington, Iowa	KCII	1380
Washington, N.J.	WCRV	1580
Washington, N.C.	WEEW	1320
	WITN	930
Washington, Pa.	WJPA	1450
	WKEG	1110
Washington Court House, Ohio	WCHO	1250
Walterboro, S.C.	WALD	1060
Waterbury, Conn.	WATR	1320
	WTBY	1590
	WWCO	1240
Waterbury, Vt.	WDEV	550
Waterloo, Iowa	KXEL	1540
	KNWS	1090
	KWWL	1330
Watertown, N.Y.	WATN	1240
	WOTT	1410
	WWNY	790
Watertown, S.Dak.	KSDR	1480
	KWAT	950
Watertown, Wis.	WTTN	1580
Water Valley, Miss.	WVLY	1320
Waterville, Me.	WTVL	1490
Watkins Glen, N.Y.	WGMF	1500
Watseka, Ill.	WGFA	1360
Watsonville, Calif.	KOMY	1340
Wauchula, Fla.	WAUC	1310
	WPRV	1600
Waukegan, Ill.	WKRS	1220
Waukesha, Wis.	WAUK	1510
Waukon, Ia.	KNEI	1140
Waupaca, Wis.	WDUX	800
Waupun, Wis.	WLKE	1170
Wausau, Wis.	WRIG	1400
	WSAU	550
	WXCO	1230
Waverly, Iowa	KWVY	1470
Waverly, Ohio	WPKO	1380
Waverly, Tenn.	WPHC	1060
Waxahachie, Tex.	KBEC	1390
Waycross, Ga.	WACL	570
	WAYX	1230
Wayne, Neb.	KTCH	1590
Waynesboro, Ga.	WBRO	1310
Waynesboro, Miss.	WABO	990
Waynesburg, Pa.	WANB	1580
Waynesboro, Tenn.	WAAN	1480
Waynesboro, Va.	WAYB	1490
	WANV	970
Waynesville, Mo.	KJPW	1390
	KFBD	1270
Waynesville, N.C.	WHCC	1400
Weatherford, Okla.	KZYX	1580
Weatherford, Tex.	KZEE	1220
Webster City, Iowa	KJFJ	1570
Weirton, W.Va.	WEIR	1430
Weiser, Idaho	KWEI	1260
Welch, W.Va.	WELC	1150
	WQVE	1340
Weldon, N.C.	WSMY	1400
Wellington, Kan.	KLEY	1130
Wellsboro, Pa.	WNBT	1490
Wellston, Ohio	WKOV	1330
Wellsville, N.Y.	WLSV	790
Wenatchee, Wash.	KPQ	560
Wendell-Zebulon, N.C.	KMEL	1340
	KUEN	900
	WETC	540
Weslaco, Tex.	KRGV	1290
West Allis, Wis.	WAWA	1590
W. Bend, Wis.	WBKV	1470
Westbrook, Me.	WJAB	1440
West Chester, Pa.	WCHE	1520
West Covina, Cal.	KQRB	900
W. Frankfort, Ill.	WFRX	1300
W. Hartford, Conn.	WEXT	1550
West Jefferson, N.C.	WKSK	1600
W. Liberty, Ky.	WLKS	1450
W. Memphis, Ark.	KSUD	730
W. Monroe, La.	KUZN	1310
W. Palm Beach, Fla.	WEAT	850
	WJNO	1230
	WIRK	1290
West Plains, Mo.	KWPM	1450
West Point, Ga.	WBMK	1310
West Point, Miss.	WROB	1450
Westport, Conn.	WMMM	1260
W. Springfield, Mass.	WTXL	1490
W. Yarmouth, Mass.	WOCB	1240
W. Yellowstone, Mont.	KWYS	920
Westerly, R.I.	WERI	1230
Westfield, Mass.	WDEW	1570
Westminster, Md.	WTTR	1470
Weston, W.Va.	WHAW	980
West Warwick, R.I.	WSVP	1450
Wetumpka, Ala.	WETU	1250
Wewoka-Seminole, Okla.	KWSH	1260
Wharton, Tex.	KANI	1500
Wheatland, Wyo.	KYCN	1340
Wheaton, Md.	WDON	1540
Wheeling, W.Va.	WHLL	1600
	WNEU	1470
	WKWK	1400
	WWVA	1170
White Castle, La.	KEVL	1590
Whitehall, Mich.	WLRC	1490
White Plains, N.Y.	WFAS	1230
White River June., Vt.	WNHV	910
Whitesburg, Ky.	WTCW	920
Whiteville, N.C.	WENC	1220
Wichita, Kans.	KAKE	1240
	KEYN	900
	KLEO	1480
	KFDI	1070
	KFH	1330
	KWBB	1410
Wichita Falls, Tex.	KNIN	990
	KTRN	1290
	KWFT	620
Wickenburg, Ariz.	KSWW	1250
Wickford, R.I.	WKFD	1370
Wiggins, Miss.	WIGG	1420
Wilcox, Ariz.	KHIL	1250
Wildwood, N.J.	WCMC	1230
Wilkes-Barre, Pa.	WBAX	1240
	WBRE	1340
	WILK	980
Wilkesboro, N.C.	WWWC	1240
Willcox, Ariz.	KHIL	1250
Williams, Ariz.	KCYN	1240
Williamsburg, Ky.	WEZJ	1440
Williamsburg, Va.	WBCI	740
Williamson, W.Va.	WBTH	1400

WHITE'S RADIO LOG

Location	C.L.	kHz
Williamsport, Pa.	WLYC	1050
	WRAK	1400
	WWPA	1340
Williamston, N.C.	WIAM	900
Willimantic, Conn.	WILI	1400
Williston, N.D.	KEYZ	1360
Willmar, Minn.	KWLM	1340
Willoughby, Ohio	WELW	1330
Willow Springs, Mo.	KUKU	1330
Willows, Calif.	KIQS	1560
Wilmington, Del.	WAMS	1880
	WDEL	1150
	WILM	1450
	WTUX	1290
Wilmington, N.C.	WMFD	630
	WHSL	1490
	WKLM	980
	WGNI	1340
Wilmington, O.	WMWM	1090
Wilson, N.C.	WGTM	590
	WLLY	1350
	WVOT	1420
Winchester, Ky.	WWKY	1380
Winchester, Tenn.	WCDT	1340
Winchester, Va.	WINC	1400
	WHPL	610
Windber, Pa.	WWBR	1350
Winder, Ga.	WIMO	1300
Windermere, Fla.	WVCF	1480
Windom, Minn.	KDOM	1580
Window Rock, Ariz.	KHAC	1300
Windsor, Colo.	KUAD	1170
Windsor, Conn.	WKND	1480
Windsor, N.C.	WBTE	990
Winnemucca, Nev.	KWNA	1400
Winfield, Ala.	WEZQ	1300
Winfield, Kan.	KNIC	1550
Winnfield, La.	KVCL	1270
Winner, S.Dak.	KWYR	1260
Winnsboro, La.	KMAR	1570
Winnsboro, S.C.	WCKM	1250
Winona, Minn.	KWNO	1230
	KAGE	1380
Winona, Miss.	WONA	1570
Winslow, Ariz.	KVNC	1010
	KINO	1230
Winston-Salem, N.C.	WAAA	980
	WAIR	1340
	WCFM	1550
	WSJS	600
	WTOB	1380
	WKBX	1500
Winter Garden, Fla.	WOKB	1600
Winter Haven, Fla.	WSIR	1490
	WINT	1360
Winter Park, Fla.	WABR	1440
Wisconsin, Dells, Wis.	WWDA	990
Wisconsin Rapids, Wis.	WFHR	1320
	WTMB	1460
Wolfeboro, N.H.	WASR	1420
Wolf Pt., Mont.	KVCK	1450
Woodburn, Ore.	KWRC	940
Woodbury, Tenn.	WBFJ	1540
Wood River, Ill.	WRTH	590
Woodruff, S.C.	WSJW	1510
Woodville, Tex.	KVLL	1220
Woodward, Okla.	KSIW	1450
Woonsocket, R.I.	WNRI	1380
	WWON	1240
Wooster, Ohio	WWST	960
Worcester, Mass.	WAAB	1440
	WNEB	1230
	WORC	1310
	WTAG	580
Worland, Wyo.	KWOR	1340
Worthington, Minn.	KWOA	730
Worthington, Ohio	WRFD	880
Wynne, Ark.	KWYN	1400
Wyoming, Mich.	WERX	1530
Wytheville, Va.	WYVE	1280
Xenia, O.	WELX	1110
	WGIC	1500
Yadkinville, N.C.	WYDK	1480
Yakima, Wash.	KIT	1280
	KMWX	1460
	KBBO	1390
	KQOT	930
	KUTI	980
	KYAK	1390
Yankton, S.D.	KYNT	1450
	WNAX	570
Yauco, P.R.	WKFE	1550
Yazoo City, Miss.	WAZF	1230
York, Nebr.	KAWL	1370
York, Pa.	WNOW	1250
	WSBA	910
York, S.C.	WYCL	980
Youngstown, Ohio	WBBW	1240
	WFMJ	1390
	WKBN	570
Ypsilanti, Mich.	WSDS	1480
	WYNZ	1520
Yreka, Calif.	KSYC	1490
Yuba City, Calif.	KUBA	1600
	KOBO	1450
Yuma, Ariz.	KBLU	1320
	KVOY	1400
	KYUM	560
Zanesville, Ohio	WHIZ	1240
Zarephath, N.J.	WAWZ	1380
Zebulon-Wendell, N.C.	WETC	540
Zephyrhills, Fla.	WPAS	1400
Zion, Ill.	WZBN	1500

White's World-Wide Shortwave Stations

Prepared by Don Jensen

I heard a country die!

For those who think of SWL'ing mostly in terms of DX programs and QSL's, the tragedy of Biafra, as reflected by its last few broadcasts, should have been an eyeopener. Shortwave radio, as a medium of immediacy, indeed was demonstrated during those days of mid-January. For those DXers, like me, who heard Radio Biafra's death throes, it was an experience not soon forgotten.

I had felt a special closeness to the station since researching the article, "Biafra's Incredible Radio," (Science and Electronics, Dec./Jan. 1969-70). So, with the word that Nigerian forces finally had broken through Biafran defences, I began carefully monitoring the station's two frequencies, 6,143 and 7,307 kHz.

Sunday, January 11, found the 41-meter Radio Biafra programming normally. Texas DXer Del Hirst noted the foreign service, Voice of Biafra, doing well on 49 meters around 0600 GMT.

But the next day, the town of Orlu, site of the two transmitters, was overrun, and with it, apparently, the semi-permanent 6,143 kHz. unit, which has not been heard since. Radio Biafra's second station, a portable, truck-mounted rig, was moved to Uga, near the key airstrip at Uli. From there, Biafran General Philip Effiong broadcast his country's capitulation. Throughout the day, the station remained on the air, playing somber music.

When Nigerian planes and artillery blasted the air field to rubble, the station-on-wheels moved again, this time to the remote village of Obolo-Uku, 17 miles southeast of Orlu. While surrender details were being negotiated, Radio Biafra aired mostly music, with a few futile pleas to its people to "keep calm."

I heard a country die!

It was early on the morning of January 14. Tuned to 7,307 kHz., I strained to hear what may have been the last free Biafran broadcast audible in the U.S. Weak and distorted, the uninterrupted program of Negro spirituals was the saddest thing I've heard in over two decades of DXing. Then, as I listened, the faltering signal faded to nothingness.

A few hours later, a column of the Nigerian Third Marine Commandos entered the village and took over the transmitter. Quickly it was incorporated into the federal network. The station continued to operate, but Biafra's incredible radio was *dead!*

Since then, in an attempt to heal the wounds of war, the government has rehired some 20 ex-Radio Biafra broadcasters. Back in Enugu, they are rebuilding a new network in what now is called Nigeria's East Central State.

"Namba Wan Wailis!" That, in Pidgin English, means quality radio (literally, "number one wireless"). And, today, there's some first class radio listening coming out of the Australian Territory of Papua and New Guinea, thanks to

This Issue's Shortwave Contributors

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Science and Electronics Propagation Forecast for June/July 1970

Prepared by C. M. Stanbury II

LISTENER'S STANDARD TIME	ASIA (except Near East)	EUROPE, NEAR EAST & AFRICA (N. of the Sahara)	AFRICA (S. of the Sahara)	SOUTH PACIFIC	LATIN AMERICA
0000-0300	25	31, 41	41, (49), (60e)	41, (49), (60w)	49, 60
0300-0600	31, 41, (49w)	31 (poor)	nil	49, 60, (75), 90	49, 60
0600-0900	25, (41w)	(16), 19	19	25, 31	31
0900-1200	19, 25	(16), 19	19, 25	25	(16), 25
1200-1500	19	(16), 19	19, 25	19	(16), 25
1500-1800	19, (31e)	25, 31	31, 60e	19, 25	(16), 25, 31
1800-2100	16, 19	25, 31	25, 31e, 60, 90w	16, 19	49, 60
2100-2400	16, 19, (31w)	31, 41, 49	60, 90	19, (31w)	49, 60

a governmental agency known as the Administration Broadcasting Service (A.B.S.).

Currently, the A.B.S. operates nine different shortwave stations in the eastern end of New Guinea and neighboring islands. Their job is to broadcast entertainment and educational features to the people of the world's largest island. They program in such exotic languages as Tolai, Toaripa, Medlpa, Police Motu, and, of course, Pidgin English.

Quite widely heard in North America are the three 10 kW stations, Radio Rabaul, on New Britain Island, Radio Western District, at Daru, and Radio Wewak, on the north coast of New Guinea. Radio Bougainville (2000 watts), in the Australian-administered part of the Solomons chain, also is being reported fairly regularly.

A brand new outlet, VL8BM, in Port Moresby, came on the air last November. Reportedly the network's key station, it will relay A.B.S. newscasts to the more remote transmitters. The remaining four stations, Radios Kerema, Goroka, Mt. Hagen and Milne Bay, 250-watts each, are rarely heard in the U.S.

CALL, LOCATION	kHz	GMT
VL8BM, A.B.S. Port Moresby	11,880	0100-0200 0430-0530
VL9BR, Radio Rabaul	3,385	0600-1300
VL9CD, Radio Wewak	3,335	0615-1230
VL8BD, Radio Western District	3,305	0645-1200
VL8BK, Radio Kerema	3,245	0700-1200
VL9BA, Radio Bougainville	3,322.5	0700-1200
VL8AS, Radio Milne Bay	3,235	0700-1200
VL9CH, Radio Mt. Hagen	2,450	0730-1130
VL9CG, Radio Goroka	2,410	0700-1200

Here's a rundown on the A.B.S. stations. How many of them can you log?

Eight other A.B.S. stations are on the drawing board, reports DXer Richard Wood in Hawaii. They're planned for Lae, Madang, Kavieng, Popondetta, Mendi, Kundiawa, Vanimo and Kimbe.

And that ought to be enough "namba wan" DX for anyone!

Three Cheers! New Zealand's Mr. DX, Arthur Cushen, who has won more awards than Aunt Martha's apple pies, has chalked up yet another honor, this one from Queen Elizabeth, herself.

In the Queen's New Year Honors, the blind listener from Invercargill was awarded the M.B.E. for community service in broadcasting, journalism and assistance to the visually handicapped. The M.B.E. is the fifth class in the prestigious Order of the British Empire, conferred upon subjects who render outstanding service to the Crown.

A top-ranked listener, Cushen also broadcasts DX programs over Radio New Zealand, and authors hobby articles for "Down Under" radio magazines. He has been active in social work for the blind in his country and serves as V.P. of the Dominion Association of the Blind.

Perhaps his best known humanitarian work has been the establishment of the prisoner of war monitoring service. In various conflicts since World War II, he has monitored POW messages aired by enemy stations and relayed them to loved ones. Often, Arthur's listening provided U.S. families with the first word that their sons and husbands were alive and well in enemy prison camps.

His achievements are too lengthy to list here. His award is well deserved! *(Turn page)*

WHITE'S SHORTWAVE SECTION

90-Meter Band—3200 to 3400 kHz

kHz	Call	Station Name	Location	GMT
3230	VRH8	R. Fiji	Suva, Fiji	0815
3260	—	R-TV Niger	Niamey, Niger	2130
3264	—	R. Clube Mozambique	Lorenco Marques, Mozambique	0300
3265	ZFY	R. Demerara	Georgetown, Guyana	0200
3300	—	R. Belize	Belize, Br. Honduras	0300
3316	—	R. Sierra Leone	Freetown, Sierra Leone	0600
3335	VL9CD	R. Wewak	Wewak, New Guinea Territory	1100
3339	—	R. Tanzania Zanzibar	Zanzibar	0330
3346	—	R. Zambia	Lusaka, Zambia	0400
3375	CR6RZ	Emis. Oficial	Luanda, Angola	2150
3380	—	R. Malawi	Blantyre, Malawi	0330
3385	YVQI	R. Barcelona	Barcelona, Venezuela	0330
3385	—	O.R.T.F.	Cayenne, Fr. Guiana	0030
3395	—	R. Clube Conquista	Bahia, Brazil	0100
3885	CR4AA	R. Clube Cabo Verde	Praia, Cape Verde Is.	2200
3905	—	R. Vila	Port Vila, New Hebrides Is.	0700
3999	—	Gronlands R.	Godthab, Greenland	1030

60-Meter Band—4750 to 5060 kHz

kHz	Call	Station Name	Location	GMT
4724	—	Burma Bc. Corp.	Rangoon, Burma	1300
4738	HCBK2	R. El Mundo	Guayaquil, Ecuador	0400
4770	ELWA	—	Monrovia, Liberia	0700
4775	—	R. Afghanistan	Kabul, Afghanistan	1300
4785	OAX3V	R. Horizonte	Huanuco, Peru	0445
4800	—	All India R.	Hyderabad, India	1200
4820	—	R. Angola	Luanda, Angola	0500
4825	—	R. Ashkabad	Ashkabad, USSR	0330
4828	—	Rhodesian Bc. Corp.	Gwelo, Rhodesia	0415
4830	YVOA	V. del Tachira	San Cristobal, Venezuela	0130
4872	—	R. Republik Indonesia	Sorong, Indonesia	1320
4885	—	V. of Kenya	Nairobi, Kenya	2045
4920	VLT4	Australian Bc. Corp.	Brisbane, Australia	1315
4932	—	R. Nigeria	Benin City, Nigeria	0500
4976	—	R. Uganda	Kampala, Uganda	2030
5026	—	R. Uganda	Kampala, Uganda	2030
5040	—	R. Valparaiso	Port de Paix, Haiti	0135
5040	—	R. Tblisi	Tblisi, USSR	0200
5040	YVQH	R. Maturin	Maturin, Venezuela	1100
5045	—	Emis. Guine	Bissou, Port. Guinea	2100

49-Meter Band—5950 to 6200 kHz

kHz	Call	Station Name	Location	GMT
5980	YSS	R. Nac. El Salvador	San Salvador, El Salvador	0400
5990	—	R. Sweden	Stockholm, Sweden	0100
6005	CP58	R. Progreso	La Paz, Bolivia	0500
6025	—	R. Portugal	Lisbon, Portugal	0200
6040	—	R. Sharjah	Sharjah, Trucial Oman	1500
6050	HRLP	R. America	Teguciagalpa, Honduras	0200
6055	XERM	R. Mexico	Mexico City, Mexico	0300
6060	—	RAI	Caltanisetta, Sicily	0300
6064	—	R. Singapura	Singapore	1100
6070	CFRX	—	Toronto, Canada	1600
6071	—	Thai Nat. Bc. Svc.	Bangkok, Thailand	1100
6085	—	R. Tallinn	Tallinn, USSR	2120
6105	XEQM	R. Yucatan	Merida, Mexico	1200
6125	—	R-TV Belge	Brussels, Belgium	0050
6140	—	V. Revolution	Bujumbura, Burundi	0500
6145	—	Forces Bc. Svc.	Athens, Greece	0500
6150	VLR6	Australian Bc. Corp.	Melbourne, Australia	0830
6155	—	Far East Network	Tokyo, Japan	1100
6165	—	Swiss Bc. Corp.	Berne, Switzerland	0730
6170	—	Philippine Bc. Svc.	Manila, Philippines	1200
6175	—	Vatican R.	Vatican City	0050
6195	4VHW	R. Haiti	Port au Prince, Haiti	1050
6199	—	V. Pathet Lao	Unknown	1130
6252	—	R. Pyongyang	Pyongyang, N. Korea	1045

41-Meter Band—7100 to 7300 kHz

kHz	Call	Station Name	Location	GMT
7043	—	R. Iran	Teheran, Iran	0330
7066	—	R. Tirana	Tirana, Albania	2030
7125	—	R. Warsaw	Warsaw, Poland	1930
7135	—	R. Monte Carlo	Monte Carlo, Monaco	0600
7140	—	R. Republik Indonesia	Ambon, Indonesia	1000
7140	—	British Bc. Corp Relay	Cyprus	0300
7150	—	R. Moscow	Moscow, USSR	0200
7205	CR7RB	R. Pax	Beira, Mozambique	0500
7215	—	American Forces Net.	Taipei, Taiwan	1200
7255	—	V. America Relay	Okinawa	1130
7275	—	V. Nigeria	Lagos, Nigeria	0600
7330	—	R. Moscow	Minsk, USSR	0400
7345	—	R. Prague	Prague, Czechoslovakia	0130

31-Meter Band—9500 to 9775 kHz

kHz	Call	Station Name	Location	GMT
9515	XEWW	L.V. de la America Latina	Mexico City, Mexico	0400
9520	VLT9	Australian Bc. Corp.	Port Moresby, Papua Territory	0600
9545	—	Deutsche Welle Relay	Kigali, Rwanda	0330
9550	—	R-TV Belge	Brussels, Belgium	2200
9553	YSS	R. Nac. El Salvador	San Salvador, El Salvador	0230
9570	—	R. Kuwait	Kuwait	0400
9575	YSV	L.V. del Comercio	San Salvador, El Salvador	1300
9585	ZYR56	R. Excelsior	Sao Paulo, Brazil	0100
9600	—	R. Tashkent	Tashkent, USSR	1200
9605	—	Trans World R.	Bonaire, Neth. Antilles	0000
9610	VLX9	Australian Bc. Corp.	Perth, Australia	1130
9620	—	R. Belgrade	Belgrade, Yugoslavia	1600
9680	VLW9	Australian Bc. Corp.	Melbourne, Australia	1200
9700	—	R. Sofia	Sofia, Bulgaria	0030
9710	LRX2	R. El Mundo	Buenos Aires, Argentina	0330
9715	—	R. RSA	Johannesburg, South Africa	0345
9715	—	R. Nederland	Hilversum, Netherlands	2245
9720	—	Swiss Bc. Corp.	Berne, Switzerland	0430
9725	ETLF	R. V. of Gospel	Addis Ababa, Ethiopia	0430
9730	—	R. Berlin International	Berlin, E. Germany	0100
9770	—	Oesterreich R.	Vienna, Austria	0200
9833	—	R. Budapest	Budapest, Hungary	0100
9912	—	All India R.	Delhi, India	2230
9976	—	Yemeni Royalist R.	Unknown	0410
10225	—	V. of the N.L.F.	Unknown	1300

25-Meter Band—11700 to 11975 kHz

kHz	Call	Station Name	Location	GMT
11700	—	R. Kiev	Kiev, USSR	0030
11700	—	Vatican R.	Vatican City	1700
11705	—	R. Japan	Tokyo, Japan	2300
11718	XERM	R. Mexico	Mexico City, Mexico	0215
11770	WNYW	R. New York Worldwide	New York, USA	0200
11780	ZL3	R. New Zealand	Wellington, New Zealand	0600
11780	—	R. Baghdad	Baghdad, Iraq	2045
11790	—	R. Lebanon	Beirut, Lebanon	0230

kHz	Call	Station Name	Location	GMT
11795	—	R. Peking	Peking, China	0330
11796	—	R. Ceylon	Colombo, Ceylon	0215
11800	—	R. Nac. Espana	Teneife, Canary Is.	0345
11810	—	R-TV Algerienne	Algiers, Algeria	0145
11815	—	R. Japan	Tokyo, Japan	2100
11825	—	R. Tahiti	Papeete, Tahiti	0400
11840	—	R. Portugal	Lisbon, Portugal	0330
11850	LLK	R. Norway	Oslo, Norway	2330
11850	—	All India R.	Delhi, India	0200
11855	—	R. Saudi Arabia	Jeddah, Saudi Arabia	0500
11875	—	R. Nac. Nicaragua	Managua, Nicaragua	1730
11890	—	R. Berlin International	Berlin, E. Germany	0300
11905	—	RAI	Rome, Italy	1630
11935	—	R. Portugal	Lisbon, Portugal	0400
11940	—	R. Kuwait	Kuwait	1630
11948	ZPA5	R. Encarnacion	Encarnacion, Paraguay	0200
11975	—	Windward Is. Bc. Svc.	St. George's, Grenada	0100

19-Meter Band—15100 to 15450 kHz

kHz	Call	Station Name	Location	GMT
15010	—	V. of Vietnam	Hanoi, N. Vietnam	2000
15095	—	R. Peking	Peking, China	2330
15095	ELWA	—	Monrovia, Liberia	2100
15105	—	R. Japan	Tokyo, Japan	2000
15115	—	Windward Is. Bc. Svc.	St. George's, Grenada	2130
15120	—	R. Ceylon	Colombo, Ceylon	0200
15125	—	ORTF	Paris, France	1830
15145	ZYK33	R. Jornal do Comercio	Recife, Brazil	0200
15160	TAU	R. Ankara	Ankara, Turkey	1300
15165	OZF7	R. Denmark	Copenhagen, Denmark	1300
15185	OIX4	Finnish Bc. Corp.	Pori, Finland	2330
15220	—	R. RSA	Johannesburg, South Africa	0300
15274	CXA18	SODRE	Montevideo, Uruguay	0200
15315	ETLF	R. V. Gospel	Addis Ababa, Ethiopia	1430
15345	BED49	V. Free China	Taipei, Taiwan	0310
15345	—	R. Havana Cuba	Havana, Cuba	1830
15420	—	Southeast Asia R.V.	Manila, Philippines	0000
15432	—	V. Free Korea	Seoul, Korea	0330
15440	—	Far East Bc. Corp.	Manila, Philippines	2330
15570	—	R. Pakistan	Dacca, Pakistan	0200

16-Meter Band—17700 to 17900 kHz

kHz	Call	Station Name	Location	GMT
17700	—	R. Peking	Peking, China	0100
17780	HCJB	V. Andes	Quito, Ecuador	1915
17805	—	R. RSA	Johannesburg, South Africa	0545
17810	—	R. Nederland	Hilversum, Netherlands	1800
17810	DZ16	Far East Bc. Corp.	Manila, Philippines	0100
17855	—	R. Havana Cuba	Havana, Cuba	2000
17900	—	British Bc. Corp. Relay	Tebrau, Malaysia	0030
17945	—	R. Pakistan	Karachi, Kakistan	1300

13-Meter Band—21450 to 21750 kHz

kHz	Call	Station Name	Location	GMT
21480	—	R. RSA	Johannesburg, South Africa	1845
21485	—	Vatican R.	Vatican City	1200
21540	—	Swiss Bc. Corp	Berne, Switzerland	1830
21580	—	R. Cairo	Cairo, Egypt	1330
21585	—	R. Sweden	Stockholm, Sweden	1630
21605	—	R. Afghanistan	Kabul, Afghanistan	1200
21630	—	R. Kuwait	Kuwait	1630
21720	—	R. Ghana	Accra, Ghana	1600

White's Emergency Radio Station Listings for DETROIT AREA

SCIENCE AND ELECTRONICS furnishes this exclusive listing of emergency radio stations as an aid to our many readers now engaged in the fascinating and rapidly growing hobby of monitoring emergency radio communications. We have and will be publishing similar lists devoted to different metropolitan areas in forthcoming issues so that you'll be able to accumulate a sizable array of this difficult-to-obtain data. Refer to the index on page 79 for our 1969/1970 program of emergency radio station listings.

If you desire to obtain similar lists from other areas in the United States that have not been published in this magazine to date, then we suggest you write to Communications Research Bureau, Box 56, Commack, N.Y. 11725. They may have a list that covers your locality; include a stamped, self-addressed envelope with your request.

All frequencies are megahertz (MHz) unless otherwise noted.

DETROIT CITY POLICE

Bases
KDS289 37.06
KLJ201 453.375
KQA262 155.37
KQA371 39.10 154.86 155.37 156.21 159.09 159.21 453.25 453.30 453.35 453.55 453.75 453.80
KQA414 154.86 155.37 156.21 159.09 159.21 453.25 453.30 453.35 453.55 453.70 453.75 453.80
KQB953 39.06 39.28 154.86 154.92 155.37 156.21 159.09 159.21 453.25 453.30 453.35 453.55 453.70 453.75 453.80
KQE228 159.21
KQE429 154.86 155.37 156.09 156.21 159.09 159.21
KQE641 154.86 155.37 156.21 159.09 159.21 453.25 453.30 453.35 453.55 453.75 453.80
KQ1289 159.09 453.30 453.35 453.55 453.75 453.80
Mobile unit channels: 37.06 37.38 39.06 39.10 154.65 154.92 155.85 156.03 156.09 156.15 158.91 158.97 168.625 458.25 458.35 458.375 458.55 458.70 458.75 458.80

DETROIT CITY FIRE DEPARTMENT

Bases
KQA205 154.31 154.40
KQE664 154.31 KQF382 154.31
KQE911 154.37 KQF489–99 154.31
Mobile unit channels: 153.95 154.37 154.40
Walkie Talkie channel: 153.83

MUNICIPAL AGENCIES

Town	Police		Fire	
Algonac	KIZ333	154.815	KNG514	154.37
Allen Park	KQB291	155.49	KDB915	154.22
Almont	KCY556	39.10	KDB462	46.42
Ann Arbor	KQB271	155.55	KQJ322	154.25
Ann Arbor Twp			KQJ863	154.25
Armada	KQF234	39.90	KLS499	154.13
Ash Twp			KCX388	154.43
Atlas Twp	KGJ709	155.37	KQJ557	154.19

DETROIT AREA

Town	Police		Fire	
Auburn Hts			KQC509	154.43
Augusta Twp			KQJ728	154.25
Bedford Twp			KQG247	154.43
Berkley	KQE771	155.01		
	KQE771	155.37		
Berlin Twp			KJS669	154.43
Birmingham	KQB232	155.655	KQC971	154.34
			KQE740	154.34
Blissfield	KQA278	42.58	KFB972	154.43
Bloomfield Hills	KQB325	155.655	KQJ733-4	154.43
Bloomfield Twp	KQD700	155.655	KCS992	154.43
			KQJ732	154.43
Brighton	KQA261	42.58	KQD273	154.01
Britton	KQH630	155.31		
Canton Twp			KQE971	154.37
Carleton			KCX388	154.43
Center Line	KCO352	39.78	KQG390	154.13
	KCO352	39.90		
Chelsea			KQJ520	154.25
Chesterfield Twp			KQG391	154.13
Clarkston			KQH448	154.43
Clawson	KQC428	155.595	KQG319	154.43
Clinton			KLP885	154.43
Clinton Twp			KQF484	154.13
Commerce Twp			KQF907	154.43
Comstock			KQD209	154.43
Davisburg			KCN662	154.43
Dearborn	KQA878	158.85	KAT353	154.16
Dearborn Hts	KLG482	155.37	KQF504	154.37
			KQG722	154.37
Deerfield Twp			KCI547	154.43
Dexter			KQJ831	154.25
Dundee	mobiles	37.02	KBG295	154.43
Durand	KBQ754	155.37		
East Detroit	KQF238	155.91	KQD789	154.13
Ecorse	KQA480	155.49	KCI473	154.22
Eloise	KQG781	155.37		
Erie Twp			KET204	154.43
			KQE213	154.43
			KJY710	154.43
Fair Haven			KQH268	154.37
Farmington	KQA549	155.37	KDE251	154.43
	KQA549	155.415	KDJ576	154.43
	KQA549	155.73		
Farmington Twp	KCX967	155.415		
Fenton	KQB515	154.80		
Ferndale	KQF367	154.74	KQF229-30	154.34
	KQF367	155.01		
Flat Rock	KET341	45.18	KQH289	154.43
Ft. Gratiot			KQD557	154.37
Franklin	KLE904	155.655	KQG259	154.43
Fraser	KDQ290	39.90	KQG867	154.13
Frenchtown Twp			KQD536	154.43
Gaines			KQD475	154.19
Garden City			KCN831	154.37
Gibraltar	KQH936	39.02	KQF474	154.43
Goodells	KQB272	39.10		
	KQF99	159.03		
Goodrich	KGJ709	155.37	KQJ557	154.19
	KJY903	155.37		
Grand Blanc Twp	KJI586	155.61	KQF223	154.19
Grosse Isle	KQG740	32.02	KCY223	154.43
Grosse Pt Farms	KQA437	154.95	KDP974	154.445
Hamburg			KAY255	154.01
Hamtramck	KQA694	155.61	KCY634	153.89
	KQD705	155.61		
Harrison Twp			KBA633	154.13
			KQE537	154.13
Harsens Island			KQE718	154.37
Hazel Park	KQD400	155.01	KQE958	154.34
Highland Park	KQA329	155.25	KQP217	153.89
Hinmans Corners			KFD503	154.43
Holloway			KDG873	154.43
Holly	KQC671	155.73	KDQ235	154.43
Howell	KQG559	37.10		
Huntington Woods	KQD713	155.01		
Ida Twp			KQG481	154.43
Inkster	KJW486	154.815	KQE214	154.37
Keego Harbor	KCI608	155.73	KQD957	154.43
Kimball Twp			KQH445	154.37
			KQE716	154.37
Lake Orion	KQD498	155.37	KBC207	154.43
	KQD498	155.73		
Lambertville			KQH986	154.43
LaSalle Twp			KQI245	154.43
Lathrup Village	KQG546	158.79		
Lincoln Park	KQC632	155.49	KQE762	154.22
Linden			KQF585	154.19
Livonia		153.875	KFA452	154.37
	KGL477	155.625	KF9999	154.37
	KQB717	155.79	KFB999	154.205
			KQE262	154.37

Town	Police		Fire	
			KQF616-7	154.37
			KCU827	154.43
Luna Pier			KQF864	154.13
Macomb Twp			KJP445	154.34
Madison Hts	KQD915	155.01	KLJ242	154.25
Manchester Twp			KQH269	154.37
Marine City			KQE350	154.37
Marysville			KQE538	154.43
Maybee			KDN933	154.22
Melvindale	KQB532	155.49	KQE720	154.37
Memphis	mobiles	39.10	KQH369	154.43
Milan	KLI261	37.10	KCI679	154.43
Milford	KQF485	155.73	KQJ761	154.43
Monroe	KQA929	37.10	KQB416	154.43
			KQF293	154.43
			KQD536	154.43
			KQG827	154.43
			KQG944	154.43
Mt Clemens	KQF238	155.91	KQB945	154.07
			KBA633	154.13
			KQB945	154.13
			KQE537	154.13
			KQF227	154.13
			KQF484	154.13
			KQF864	154.13
			KQG391	154.13
New Baltimore	KQB274	39.90		
New Boston	mobiles	42.58		
	mobiles	42.74		
New Haven	KGV354	39.90	KQF922	154.13
Newport			KJS669	154.43
Northfield Twp			KQJ729	154.25
Northville	KDX470	155.13	KET203	154.37
Novi	KQE809	155.73	KDK655	154.43
Oak Park	KQD361	158.79		
Orchard Lake	KQD806	155.37	KLS647	154.43
Orion Twp			KBC207	154.43
Ortonville			KQG353	154.43
Ottawa Lake			KQH295	154.43
			KJJ555	154.43
Oxford	KQF800	155.73	KAP373	154.43
Petersburg			KQD717	154.43
Pickney			KGV244	154.01
Pittsfield Twp			KCW728	154.25
Pleasant Ridge	KQD711	155.01		
Plymouth	KQA379	155.13	KDA434	154.37
			KQE267	154.37
			KQK539	154.37
Pontiac	KQB233	155.37	KBX619-22	154.34
	KQB246	155.73	KDQ208	154.34
	KJH268	155.685	KQC472	154.43
			KQF909	154.43
			KLR459	154.34
			KQF709	154.34
Pontiac Twp			KQC509	154.43
			KQC427	154.43
			KQF909	154.43
Port Huron	KQB272	39.10	KQD557	154.37
	KQG20	155.07	KQD565	154.37
	KQF99	159.03	KQE721	154.37
Putnam Twp			KGV244	154.01
Raisin			KDG873	154.43
Rankin			KQF960	154.19
Redford			KQE911	154.37
Richmond	KQE285	155.37		
Ridgeway Twp	KQH630	155.31		
Riga Twp			KLL747	154.43
River Rouge	KQA970	155.49	KQF850	154.22
Riverview	KQH308	39.02		
Rochester	KQB851	155.73		
Rockwood	KGN531	45.18	KQE407	154.43
Romeo	KQB720	39.90	KSC990	154.13
Romulus			KBH353	154.43
Roseville	KQA465	155.91	KBE834	154.13
			KQD401	154.13
Royal Oak	KQA673	154.74	KQD233	154.34
	KQA673	155.01	KQE494-6	154.34
Royal Oak Twp	KQD916	155.01		
St Clair			KDK750	154.37
			KQD565	154.37
St Clair Shrs	KQF291	155.31	KQD450	154.13
	KQF291	155.91	KQE663	154.13
Salem			KDN591	154.25
Saline	KDE702	37.10	KQJ521	154.25
Scofield			KFD503	154.43
Shelby Twp	KQF959	39.90	KQI288	154.13
Smiths Creek			KQH445	154.37
Southard			KFD503	154.43
Southgate	KQC815	155.49	KCI474	154.22
South Lyon	mobiles	42.74		
Sparlingville			KQE716	154.37
Sterling Hts			KQI251	154.13

Town	Police		Fire	
Summerfield			KQD717	154.43
Superior Twp			KQE406	154.37
Sylvan Lake	KQG766	155.73		
Taylor Twp	KDX561	155.67	KDK371-3	154.37
	KQA897	155.67		
	KQB876	155.67		
	KQD712	155,67		
Tecumseh	KQE836	155.31	KBJ210	154.43
Temperance			KQG247	154.43
Trenton	KQA796	39.02	KCO337-8	154.22
Troy	KQD359	155.595		
Utica	KGW749	39.90	KQE449	154.13
	KQB865	39.90	KQF344	154.13
	KQF959	39.90	KQI251	154.13
			KQI288	154.13
Walled Lake	KJN633	155.73	KBC657	154.43
	KQF867	155.73		
Warren	KGB275	453.13	KQD459	154.13
			KQD459	453.45
			KQG471-2	154.13
			KQG689	154.13
			KQH451	154.13
			KHH33-7	458.45
Washington			KCO342	154.13
Waterford Twp	KQE246	155.73	KCX992	154.43
			KQC357	154.43
			KQC948	154.43
Wayne	KQE692	155.37	KQB747	154.37
W Bloomfield Twp	KGL582	155.415	KLS647	154.43
			KQD957	154.43
Westland		153.875	KCZ849	154.37
	KIZ656	154.815	KFG546-7	154.37
Whiteford Twp			KQH295	154.43
			KQJ555	154.43
White Lake Twp	KCX968	155.73	KQD499	154.43
Whitmore Lake			KQJ729	154.25
Whittaker			KQJ728	154.25
Wolverine Lake	KJN663	155.73		
Woodhaven			KJO207	154.43
Wyandotte	KQA971	155.49	KBD914	154.22
Ypsilanti	KDX474	37.10	KDL917	154.25
	KQA226	155.13	KQA976	154.37
			KQE406	154.37

COUNTY AGENCIES

Genessee County	Police		Fire	
Flint	KQB863	155.61	KQF239	154.19
	KQB863	155.83		
Lapeer County				
Lapeer	KBH349	39.10	KBG529	46.42
	KBH349	39.14		
Lewanee County				
Adrian	KQA802	155.31		
Tecumseh			KQK352	154.43
Livingston County				
Howell	KQE758	37.10	KCF947	154.01
Macomb County				
Mt Clemens	KQA783	39.90		
		158.79		
Romeo	KFN552	39.90		

Town	Police		Fire	
Monroe County				
Monroe	KQA929	37.10	KQG944	154.43
Oakland County				
Milford	KQC752	155.73		
Pontiac	KQF725	155.73		
St Clair County				
Port Huron	KDA721	39.10	KQD565	154.37
Shiawassee County				
Corunna	KDQ269	155.43		
Washentaw County				
Ann Arbor	KQH905	37.10		
Ypsilanti	KDX474	37.10		
Wayne County				
Detroit	KLE916	155.37		
	KQE653	155.70		
	KQE653	159.15		
	KQG781	155.37		
N lle	KQE957	155.37		
Ro	KFM343	155.58		
	KFM343	155.70		
	KFM343	159.15		
Way	KQE692	155.37		
West	KQB611	155.70		
	KQB611	159.15		

STATE AGENCIES

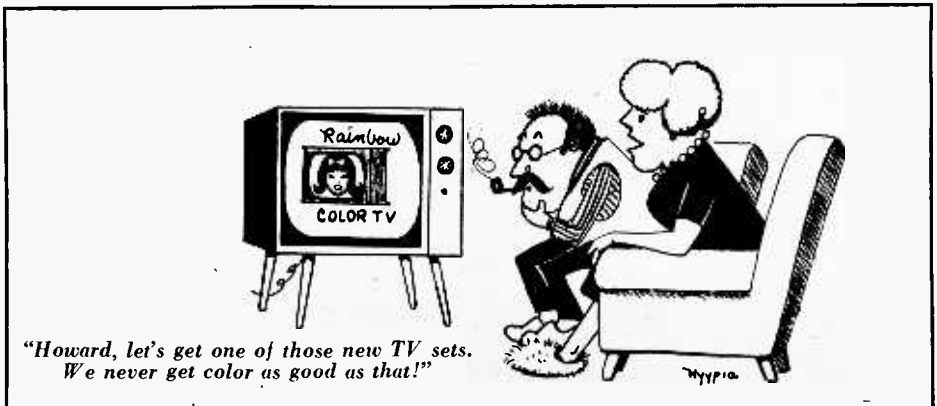
State For y Conservation networks: 44.64 44.72 44.80 46.1 151.25 151.295 Repeaters: 171.425 171.575

State Hospit olice
Ypsilanti 37.10

Michigan State Police (Detroit area)

Bad Axe	KQA272	42.58 42.68
Brighton	KQA261	42.56 42.58
Clinton	KQA276	42.58 42.68
Detroit	KQA262	42.48 42.58 154.665
	KQA20	75.98
Erie	KQA277	42.48 42.58
Flat Rock	KQA266	42.48 42.58
Inkster	KJD940	154.935
Pontiac	KQA269	42.48 42.58
Romeo	KQA263	42.48 42.58
St Clair	KQA264	42.48 42.58
Sterling Twp	KQD796	42.58
Warren	KQA265	42.48 42.58
Ypsilanti	KQA267	42.48 42.58
portable unit	KQA931	42.48 42.56 42.58 42.68
portable unit	KQE228	37.10 39.10 39.42 39.58 39.82 39.90 42.48 42.56 42.58 42.68 155.01 155.07 155.19 155.25 155.49 155.55 155.61 155.73 155.79 156.21 158.85 159.09 159.21

Mobile unit frequencies (Detroit area): 39.10 42.48 42.56 42.58 42.68 154.92 154.935



"Howard, let's get one of those new TV sets. We never get color as good as that!"

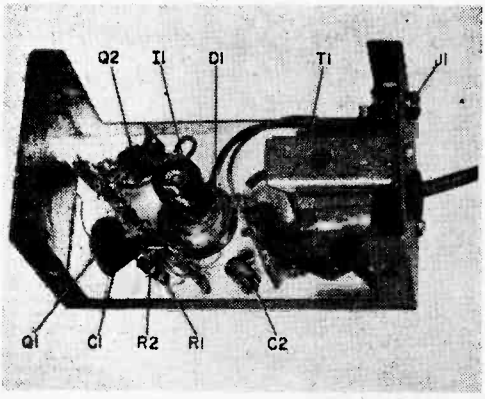
Visulert

Continued from page 48

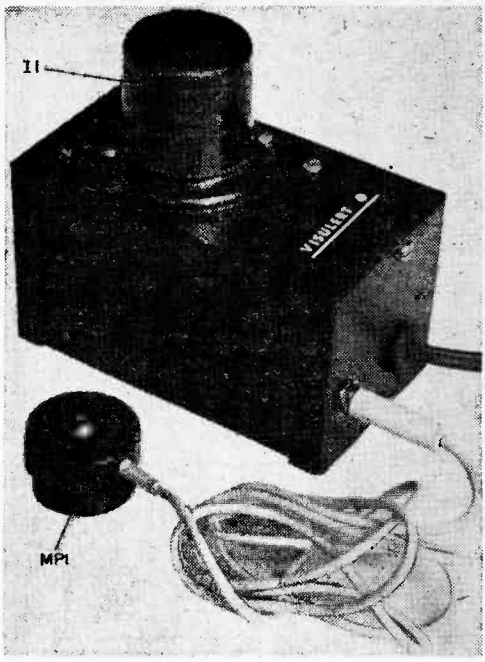
support them away from the metal to prevent shorts. Before soldering electrolytic capacitors and diodes, check to be sure that you have them properly polarized. Also, doublecheck that connections to Q1 and Q2 are correct before soldering to avoid application of too much heat, if you must unsolder and resolder them, since excessive heat can damage solid-state devices. In fact, we recommend that you use an alligator clip as a heat sink by temporarily clipping it to each lead being soldered.

Remote Lamp. In the event you require a brighter lamp than the standard bulb listed, or want the lamp located on a wall or site outside the area of the telephone—where it can be universally observed—make the following modification. Remove the bulb and connect the leads to terminal strip TB1 for connecting the remote lamp control leads. Mount a 6.3-VAC relay, a standard 110-V lamp socket, and TB2 in a container suitable for the remote location. Wire it as shown in the schematic. By using low voltage (6.3 VAC) the interconnecting remote control leads can be small-sized insulated wire. The 6.3 V that is switched by the SCR (Q2) to turn the low voltage lamp *on* and *off* will now be used to operate the remote relay, which will, in turn, control 117 VAC to the larger lamp bulb.

Checking Out Visulert. After doublechecking your hookup for possible errors, shorts, or cold soldered connections, plug the power cord into an AC outlet, and plug magnetic pickup MP1 into J1. Now bring the pickup near power transformer T1. If the unit is working correctly the radiated AC field around the transformer will produce a signal in the magnetic pickup device, triggering the SCR (Q2) to turn *on* lamp I1. Each time you move the pickup close to the transformer, the lamp will be lit; as you move MP1 away from T1's magnetic field, the lamp will go out. When this checkup has been completed you can close up the minibox and place Visulert in service.



You can see how all of unit's parts are mounted either to tie strips or directly to minibox in this opened up view of Visulert.



We used conventional round magnetic phone pickup. You may have a flat version available that can be conveniently placed under phone.

Using Visulert. The suction cup on the pickup coil we used serves a dual purpose. It permits you to easily orient MP1 into the magnetic field of the telephone ringer and also holds it in position once the ideal location is found. If the pickup you use is one of the flat types, place it under the phone near the exit of the handset cable.

Regardless of the type, you'll have to move the pickup around the base of the phone to locate the magnetic field of the ringer. Remember, of course, the only time you can locate the pickup is when the phone is ringing. Reason is that Visulert's operation is dependent upon the relatively high magnetic field of the ringer to develop a control signal to fire the SCR. ■

The Skies Above Us

Continued from page 16

following day, Sunday. This is the source of the solemn yet jubilant spring celebration of Christendom, Easter, as the Passover is solemn yet jubilant for Judaism, in the spring.

☆ Astronomers can date these events quite easily, by looking back to their records of the dates of full moons in those days. There is only one year during the later life of Jesus when the beginning of Passover fell on Thursday, and that was 30 A.D., in our present reckoning. The date was April 6. The Resurrection then, occurred on Sunday, April 9, 30 A.D.

☆ The early converts to Christianity were sharply divided between those of Jewish ancestry and the Gentiles. Those of the first group insisted that, inasmuch as the Resurrection had occurred three days after the Passover evening, the celebration of Easter should always be so dated. But the Gentiles insisted that it should always be on the day following the Sabbath after the Passover—that is, always on Sunday.

Finally, a compromise was adopted. Easter should be the first Sunday following the first full moon that falls on or after March 21. But this sometimes results in an Easter date before the Passover, as in 1970, when Easter is celebrated on March 29 and the Passover begins in the evening of April 20, which is the beginning of April 21, in the traditional Jewish daily reckoning, sunset to sunset. Except for the tricky wording of the Easter rule, the date could have been even earlier in 1970, because there is a full moon on March 22. But that falls on a Sunday, and the rule states that Easter must be on the Sunday *after* that first full moon *on or after* March 21. So Easter had to be set on March 29.

☆ The dates of both the Passover and Easter (earliest on March 22, latest on April 25) can, as we have seen, wander through several weeks, yet the events they commemorate occurred on definite days. Because of its link with Passover during the life of Jesus, the dates of the Last Supper and the events that followed in the next few days have been definitely established. Perhaps scholarly archaeological and historical work will someday establish the exact date in the year of the seasons when the Israelites fled from Egypt. Is it too much to hope that we may settle on the full moon next after March 21 as the beginning of Passover and on the Sunday following that as the date of Easter, just as a beginning?

☆ Of one thing we can probably be sure. Our calendars, based upon primitive astronomy and the desire to preserve ancient traditions, have not completed their evolutions. As any other timekeeper, a calendar should appeal to the needs of the people, and irregularity and mystical jumping through the days of the year of the seasons is something that is distracting and sometimes even damaging in our tightly-geared modern world which would seem to thrive best on regularity. ■

DXers' Old Mexico

Continued from page 65

quencies (VHF), reception is ordinarily limited to line-of-sight range. TV and FM DXing is a whole story itself, but suffice it to say that during the early summer months, and to a lesser degree, during the post-Christmas period, long-haul logging is possible, via E-skip ionospheric propagation. With a single skip of up to about 1500 miles, the Mexican border FM-TV stations are possible catches for many in the States. At least two hops of the signals are needed to receive the Mexico City stations—and this is rare, indeed!

Another form of VHF propagation, tropospheric bending, can bring the border stations to American TV screens located up to 400-500 miles away. A word of caution, though. Don't be fooled into thinking that any FM-TV program you hear in Spanish is from a Mexican station. It could be, but some U.S. stations have some Spanish-language programming, too. Moral: Don't jump to conclusions!

If you live in the southwest, your chances of logging Mexican TV or FM are pretty good. Elsewhere, you're up against the vagaries of ionospheric propagation. But, with luck, one day you may experience the thrill of seeing "XEFB-TV, Monterrey, canal 3," flash across your boob-toob! ■

Ham Traffic

Continued from page 66

lows in the Indianapolis area who wanted to obtain ham tickets, or to obtain higher class tickets than they already had.

Reports W9DIW: "It's much easier for a group to make progress than trying it by one's self. The credit must go to W9SFU for his patience and trouble." ■

Men of Science

continued from page 36

the Royal Society of London and a prize of 3000 francs from the Paris Institute—quite a bundle of honors for an apothecary's son.

Hans began working in his father's shop at 12, so had little formal schooling before he entered the University of Copenhagen in 1793. His father had hoped he would be a poet and found it hard to conceal his disappointment when the youth chose to study for a Doctor of Medicine degree.

He won his diploma but never established a practice. Instead he wandered about Europe for several years before returning home and accepting a post as Professor of Physics in the University of Copenhagen.

After his one shining hour, his life became rather drab. True, he instituted lectures to females in spite of community objections. And he managed to publish a few essays and a notably unsuccessful book on *The Soul in Nature.*

Oh, yes. In 1825 he claimed to have produced a new and rare metal by chemical process. Thing is, scientists discounted his report since they failed to get the same result when they went through the process briefly outlined in a published report.

Late in life he tried (without success) to measure the compressibility of water, reluctantly admitted to himself that his only significant achievement hinged on that classroom discovery made many years earlier.

When Oersted died, students honored him with a parade. As a special tribute, they laid a wreath of genuine silver on his coffin.

Had they been able to see into the future, however, they would have known that silver was totally inappropriate. For within months after his death, new techniques made it possible to actually produce a small quantity of the metal which Oersted had babbled about in 1825. The first object ever made of it was a rattle for Napoleon III's infant son; today, world production ranges above 6,000,000 tons annually.

With the light metal firmly established as a basic resource for modern technology, detailed notes by Oersted were rediscovered along about 1920. Repeating step by step the exact procedures he had followed nearly a century earlier, it was established that the father of electromagnetism was also the discoverer of aluminum. ■

NutZee

Continued from page 76

up a jack as shown in our drawing.

Suppose you have a component stereo system capable of driving low-efficiency speakers and you want to switch from them to your NutZees. In this case you would use a remote speaker switch and an L-pad. An L-pad is necessary because it cuts down the amount of watts delivered to NutZee. Without it, you stand a chance of burning out your NutZee the first time you switch from the component speaker system.

The L-pad, a Lafayette 99T6134 or equivalent, can be any wattage rating; just make sure that it will work with an 8-ohm speaker. You probably won't have to crack it open very far, owing to NutZee's ability to deliver bull-sized sound from flea-sized power.

When you're shopping for the remote speaker switch, pay particular attention to the switch's intended use. Some switches, like the Lafayette 99E01752, work with solid-state systems, but others, such as Lafayette's 99E00838, will mate only with tube-driven equipment. Here's the difference: transistorized amplifiers need a make-before-break switch but tubed amplifiers like to see a constant load at the output terminals. Our drawing explains the remote switch/L-pad arrangement.

You may wish to wall-mount your NutZees; the procedure is sheer simplicity. Merely locate another plastic top (from another peanut can) and thumbtack it to the wall. Now span NutZee's bottom in, and prepare yourself for a canned music treat. ■

Bookmark

Continued from page 12

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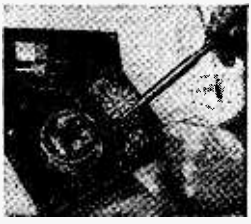

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PROGRESSIVE HOME RADIO-T.V. COURSE

Now Includes

- ★ 12 RECEIVERS
- ★ 3 TRANSMITTERS
- ★ SQ. WAVE GENERATOR
- ★ SIGNAL TRACER
- ★ AMPLIFIER
- ★ SIGNAL INJECTOR
- ★ CODE OSCILLATOR

- ★ No Knowledge of Radio Necessary
- ★ No Additional Parts or Tools Needed
- ★ EXCELLENT BACKGROUND FOR TV
- ★ SCHOOL INQUIRIES INVITED
- ★ Sold In 79 Countries

Reg. U. S. Pat. Off.

Training Electronics Technicians Since 1946

YOU DON'T HAVE TO SPEND HUNDREDS OF DOLLARS FOR A RADIO COURSE

The "Edu-Kit" offers you an outstanding PRACTICAL HOME RADIO COURSE at a rock-bottom price. Our Kit is designed to train Radio & Electronics Technicians, making use of the most modern methods of home training. You will learn radio theory, construction practice and servicing. THIS IS A COMPLETE RADIO COURSE IN EVERY DETAIL.

You will learn how to build radios, using regular schematics; how to wire and solder in a professional manner; how to service radios. You will work with the standard type of punched metal chassis as well as the latest development of Printed Circuit chassis.

You will learn the basic principles of radio. You will construct, study and work with RF and AF amplifiers and oscillators, detectors, rectifiers, test equipment. You will learn and practice code, using the Progressive Code Oscillator. You will learn and practice trouble-shooting, using the Progressive Signal Tracer, Progressive Signal Injector, Progressive Dynamic Radio & Electronics Tester, Square Wave Generator and the accompanying instructional material.

You will receive training for the Novice, Technician and General Classes of F.C.C. Radio Amateur Licenses. You will build Receiver, Transmitter, Square Wave Generator, Code Oscillator, Signal Tracer and Signal Injector circuits, and learn how to operate them. You will receive an excellent background for television, Hi-Fi and Electronics.

Absolutely no previous knowledge of radio or science is required. The "Edu-Kit" is the product of many years of teaching and engineering experience. The "Edu-Kit" will provide you with a basic education in Electronics and Radio, worth many times the low price you pay. The Signal Tracer alone is worth more than the price of the kit.

THE KIT FOR EVERYONE

You do not need the slightest background in radio or science. Whether you are interested in Radio & Electronics because you want an interesting hobby, a well paying business or a job with a future, you will find the "Edu-Kit" a worth-while investment. Many thousands of individuals of all ages and backgrounds have successfully used the "Edu-Kit" in more than 79 countries of the world. The "Edu-Kit" has been carefully designed, step by step, so that you cannot make a mistake. The "Edu-Kit" allows you to teach yourself at your own rate. No instructor is necessary.

PROGRESSIVE TEACHING METHOD

The Progressive Radio "Edu-Kit" is the foremost educational radio kit in the world, and is universally accepted as the standard in the field of electronics training. The "Edu-Kit" uses the modern educational principle of "Learn by Doing." Therefore you construct, learn schematics, study theory, practice trouble shooting—all in a closely integrated program designed to provide an easily-learned, thorough and interesting background in radio.

You begin by examining the various radio parts of the "Edu-Kit." You then learn the function, theory and wiring of these parts. Then you build a simple radio. With this first set you will enjoy listening to regular broadcast stations, learn theory, Practice testing and trouble-shooting. Then you build more advanced radios, more advanced theory and techniques. Gradually, in a progressive manner, and at your own rate, you will find yourself constructing more advanced multi-tube radio, circuits, and doing work like a professional Radio Technician.

Included in the "Edu-Kit" course are Receiver, Transmitter, Code Oscillator, Signal Tracer, Square Wave Generator and Signal Injector Circuits. These are not unprofessional "breadboard" experiments, but genuine radio circuits, constructed by means of professional wiring and soldering on metal chassis, plus the new method of radio construction known as "Printed Circuitry." These circuits operate on your regular AC or DC house current.

THE "EDU-KIT" IS COMPLETE

You will receive all parts and instructions necessary to build twenty different radio and electronics circuits, each guaranteed to operate. Our Kits contain tubes, tube sockets, variable, electrolytic, mica, ceramic and paper dielectric condensers, resistors, tie strips, hardware, tubing, punched metal chassis, Instruction Manuals, hook-up wire, solder, selenium rectifiers, coils, volume controls and switches, etc.

In addition, you receive Printed Circuit materials, including Printed Circuit chassis, special tube sockets, hardware and instructions. You also receive a useful set of tools, a professional electric soldering iron, and a self-powered Dynamic Radio and Electronics Tester. The "Edu-Kit" also includes Code Instructions and the Progressive Code Oscillator, in addition to F.C.C. Radio Amateur License training. You will also receive lessons for servicing with the Progressive Signal Tracer and the Progressive Signal Injector, a High Fidelity Guide and a Quiz Book. You receive Membership in Radio-TV Club, Free Consultation Service, Certificate of Merit and Discount Privileges. You receive all parts, tools, instructions, etc. Everything is yours to keep.

Progressive "Edu-Kits" Inc., 1189 Broadway, Dept. 560NN, Hewlett, N. Y. 11557

FREE EXTRAS

- **SET OF TOOLS**
- SOLDERING IRON
- ELECTRONICS TESTER
- PLIERS-CUTTERS
- VALUABLE DISCOUNT CARD
- CERTIFICATE OF MERIT
- TESTER INSTRUCTION MANUAL
- HIGH FIDELITY GUIDE • QUIZZES
- TELEVISION BOOK • RADIO TROUBLE-SHOOTING BOOK
- MEMBERSHIP IN RADIO-TV CLUB: CONSULTATION SERVICE • FCC AMATEUR LICENSE TRAINING
- PRINTED CIRCUITRY

SERVICING LESSONS

You will learn trouble-shooting and servicing in a progressive manner. You will practice repairs on the sets that you construct. You will learn symptoms and causes of trouble in home, portable and car radios. You will learn how to use the professional Signal Tracer, the unique Signal Injector and the dynamic Radio & Electronics Tester. While you are learning in this practical way, you will be able to do many a repair job for your friends and neighbors, and charge fees which will far exceed the price of the "Edu-Kit." Our Consultation Service will help you with any technical problems you may have.

FROM OUR MAIL BAG

J. Stataitis, of 25 Poplar Pl., Waterbury, Conn., writes: "I have repaired several sets for my friends, and made money. The "Edu-Kit" paid for itself. I was ready to spend $240 for a Course, but I found your ad and sent for your Kit."

Ben Valerio, P. O. Box 21, Magna, Utah: "The Edu-Kits are wonderful. Here I am sending you the questions and also the answers I have been in Radio for the last seven years, but like to work with Radio Kits, and like to build Radio Testing Equipment. I enjoyed every minute I worked with the different kits; the Signal Tracer works fine. Also like to let you know that I feel proud of becoming a member of your Radio-TV Club."

Robert L. Shuff, 1534 Monroe Ave., Huntington, W. Va.: "Thought I would drop you a few lines to say that I received my Edu-Kit, and was really amazed that such a bargain can be had at such a low price. I have already started repairing radios and phonographs. My friends were really surprised to see me get into the swing of it so quickly. The Trouble-shooting Tester that comes with the Kit is really swell, and finds the trouble, if there is any to be found."

UNCONDITIONAL MONEY-BACK GUARANTEE

Please rush my Progressive Radio "Edu-Kit" to me, as indicated below:
Check one box to indicate choice of model

- ☐ Deluxe Model $31.95.
- ☐ New Expanded Model $34.95 (Same as Deluxe Model plus Television Servicing Course).

Check one box to indicate manner of payment

- ☐ I enclose full payment. Ship "Edu-Kit" post paid.
- ☐ I enclose $5 deposit. Ship "Edu-Kit" C.O.D. for balance plus postage.
- ☐ Send me FREE additional information describing "Edu-Kit."

Name .....

Address .....

City & State ..... Zip .....

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PRINTED CIRCUITRY

At no increase in price, the "Edu-Kit" now includes Printed Circuitry. You build a Printed Circuit Signal Injector, a unique servicing instrument that can detect many Radio and TV troubles. This revolutionary new technique of radio construction is now becoming popular in commercial radio and TV sets.

A Printed Circuit is a special insulated chassis on which has been deposited a conducting material which takes the place of wiring. The various parts are merely plugged in and soldered to terminals.

Printed Circuitry is the basis of modern Automation Electronics. A knowledge of this subject is a necessity today for anyone interested in Electronics.